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ORIGINAL

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Aerodynamic Performance of Axial-Flow Fan Stage Operated at Nine Inlet Guide Vane Angles

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National Aeronautics
and Space Administration

**Scientific and Technical
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SUMMARY

The overall performance of a fan stage suitable for vertical-lift aircraft is presented for nine inlet guide vane angle settings. Data were obtained over the stable flow range at speeds from 60 to 120 percent of design for vane setting angles from -25° to 42.5°. At design speed and design inlet guide vane angle, the stage had a peak efficiency of 0.892 at a pressure ratio of 1.322 and a flow of 25.31 kilograms per second. The stall margin based on flow and pressure ratio at peak efficiency and stall was 20 percent.

Based on an operating line passing through the peak efficiency point at the design setting angle, the useful operating range of the stage at design speed is limited by stall at the positive setting angles (32.5°) and by choke at the negative angles (-17.5°). The calculated static thrust along the operating line varied from 68 to 114 percent of that obtained at the design setting angle.

INTRODUCTION

The research program on axial-flow fans and compressors for advanced air breathing engines being conducted at the NASA Lewis Research Center is primarily directed toward improving the performance and reducing the size, weight, and cost of these components. As a part of this program, experimental studies have been conducted on fan stages with variable-pitch-rotor-blades suitable for use in engines for powered-lift aircraft (refs. 1 to 7). The results from these investigations indicated that some of the various flight requirements could be achieved using engines with such fan stages.

The Lewis Research Center is studying various engine concepts for vertical-lift aircraft. Not only are the cruise requirements more demanding than those for powered-lift aircraft, there is also a takeoff and landing requirement that the thrust for each engine be varied to provide aircraft stability control. Two of the methods being considered for varying the thrust are the use of variable-pitch rotor blades and the use of variable inlet guide vanes. The performance of a fan stage with variable-pitch rotor blades operating over a range of angle settings is presented in reference 8. The performance of the same fan stage with the rotor blades at a fixed setting angle is presented in the report for nine inlet guide vane angles.

The variable inlet guide vanes were designed and fabricated by Hamilton Standard Division of the United Technologies Corporation to be added to the 1.38-pressure-ratio variable-pitch-rotor fan stage previously tested. The stage with the inlet guide vanes

was tested by Lewis at speeds from 60 to 120 percent of design and inlet guide vane angles from -25° to 42.5°. It was anticipated that this angle variation would give a significant range in fan thrust at design speed. This report presents the overall performance of the stage operated at nine inlet guide vane setting angles.

TEST STAGE

The test stage (figs. 1 and 2), designated stage 57M2, was designed and fabricated by the Hamilton Standard Division of the United Technologies Corporation. The rotor and stator are those described in reference 8. The inlet guide vanes (IGV's) were designed to be added to that stage. From the previous tests on the fan stage (ref. 8), it appears that the efficiency would be optimum at a rotor setting angle of 6° (closed). Thus the rotor-blade setting angle for stage 57M2 was set at 6°. The casing diameter above the rotor tip was constant, and the rotor was machined to have a constant clearance from blade leading to trailing edge. The 20 inlet guide vanes were of NACA 63-009 series profiles. In their design position the vanes are alined to the axial direction. As shown in figure 3, the front portion of the blades was stationary, and the rear portion was movable.

The stage was tested with the inlet guide vanes set at nine angles. Listed below are the stage designations for each setting angle:

Stage	Inlet guide vane setting angle, deg from design
57M2A	0
57M2B	-10.0
57M2C	-17.5
57M2D	-25.0
57M2E	10.0
57M2F	17.5
57M2G	25.0
57M2H	32.5
57M2I	42.5

APPARATUS AND PROCEDURE

Test Facility

The fan stage was tested in the Lewis single-stage compressor test facility, which is diagramed in figure 4. Atmospheric air enters the test facility at a inlet located on the roof of the building, and flows through the flow measuring orifice into the plenum chamber upstream of the test stage. The air then passes through the experimental fan stage into the collector and is exhausted to the facility exhaust system.

Instrumentation

The fan flow was determined from the measurements on a calibrated thin-plate orifice that was 38.9 centimeters in diameter. The orifice temperature was determined from an average of two Chromel-Constantan thermocouples. Orifice pressures were measured by calibrated transducers.

Radial surveys of the flow were made upstream of the IGV's, between the IGV's and the rotor, between the rotor and the stator, and downstream of the stator (see fig. 1 for axial locations). Photographs of the survey instrumentation are shown in figure 5. At stations 0 and 2 total pressure, total temperature, and flow angle were measured with the combination probe (fig. 5(a)), and the static pressure was measured with an 18^{o} wedge probe (fig. 5(b)). At stations 1 and 3 total pressure and total temperature were measured with the nine-element radial rake (figs. 5(c) and (d)). The static pressure and flow angle were determined from the wedge probe. Each probe was positioned with a null-balancing stream-direction-sensitive control system that automatically alined the probe to the direction of flow. At station 3 the rakes were set straight ahead. At station 1 the rakes were set to match the IGV angle. The thermocouples were Chromel-Constantan for both the combination probe and the rake.

Inner- and outer-wall static-pressure taps were located at approximately the same axial stations as the survey instrumentation. The circumferential locations of the survey instrumentation along with the inner- and outer-wall static-pressure taps are shown in figure 6.

An electronic speed counter, in conjunction with a magnetic pickup, was used to measure rotative speed (rpm).

The estimated errors of the data based on inherent accuracies of the instrumentation and recording system are as follows:

Airflow, kg/sec	±0.3
Rotative speed, rpm	±30
Flow angle, deg	±1.0

Temperature, K	±0.6
Rotor-inlet total pressure, N/cm^2	±0.04
Rotor-outlet total pressure, N/cm^2	±0.10
Stator-outlet total pressure, N/cm^2	±0.10
Rotor-inlet static pressure, N/cm^2	±0.04
Rotor-outlet static pressure, N/cm^2	±0.10
Stator-outlet static pressure, N/cm^2	±0.10
IGV inlet total pressure, N/cm^2	±0.01
IGV inlet static pressure, N/cm^2	±0.04

Test Procedure

The stage survey data for each configuration were taken over a range of speeds from 60 to 120 percent of design speed and a range of flows from maximum to near-stall conditions. The data were recorded at nine radial positions for each speed and weight flow.

The combination probes at stations 0 and 2 and the wedge probes at all stations were traversed radially at the same time the nine-element rakes at stations 1 and 3 were traversed circumferentially. The wedge probes were set at midgap because previous studies showed that the static pressure across the stator gap was constant. The probes and rakes were set at their initial position and values of pressure, temperature, and flow angle were recorded. The instruments are then traversed to their next scheduled position, and data were again recorded. When the rakes are at their last circumferential position, the probes are at their last radial position.

Calculation Procedure

Measured values of total pressure, static pressure, and total temperature were corrected for Mach number and streamline slope. These corrections were based on an average calibration for the type of instrument used. Orifice airflow, rotative speed, static and total pressures, and total temperatures were all corrected to standard-day conditions based on the IGV inlet condition.

For the data reduction program the circumferential distributions of static pressure and flow angle downstream of the inlet guide vane (station 1) and stator (station 3) were assumed to be constant for each radial position and equal to the measured midgap values. The nine values of total temperature were mass-averaged to obtain the stator-outlet temperature. The nine values of total pressure were converted to their enthalpy equivalents and then mass averaged.

To obtain the overall performance, the radial values of total temperature were mass averaged, and the values of total pressure were converted to their enthalpy equivalent and then mass averaged as before.

The sea-level static thrust is composed of both the momentum thrust and the pressure thrust. The momentum thrust is a product of the flow rate and the outlet velocity. The pressure thrust consists of a product of the outlet area and the difference between outlet static pressure and inlet total pressure. The symbols and equations are defined in appendixes A and B.

The weight flow at stall was obtained in the following manner: during operation at the near-stall condition, the collector valve was slowly closed in small increments. At each increment the air flow was obtained. The air flow obtained just before stall occurred is defined as the stall air flow. The pressure ratio at stall was obtained by extrapolating the total pressure obtained from the survey data to the stall air flow.

RESULTS AND DISCUSSION

The results from this investigation are presented in three sections. The overall performance of the rotor and stage for the design inlet guide vane angle are presented first. (The rotor is the same as that presented in ref. 8, but the blades are set at 6° closed.) The effects of vane angle on the overall performance are then presented. Finally, the effects of vane angle on calculated static thrust are discussed. The overall performances for all nine inlet guide vane angles are presented in tables I to IX.

Performance with IGV at Design Angle

The overall performance for the rotor and stage are presented in figures 7 and 8, respectively. Pressure ratio and adiabatic efficiency are presented at several flows for speeds of 60, 70, 80, 90, 100, 110, and 120 percent of design. The stall line is also shown for the overall stage performance (fig. 8).

At design speed the rotor had a peak efficiency of 0.905. It occurred at a flow of 24.06 kilograms per second and a pressure ratio of 1.361. The stage peak efficiency of 0.892 occurred at a pressure ratio of 1.322 and a flow of 25.31 kilograms per second. The stall margin was 20 percent based on flow and pressure ratio at stall and peak efficiency.

Performance Over Range of IGV Setting Angles

Performance curves for the inlet guide vanes set at nine vane setting angles for the 100 and 120 percent of design speeds are shown in figure 9. The stall lines are shown in each figure. The operating line, which passes through the design-speed peak-efficiency point at the 0° vane angle, was obtained by setting a constant throttle valve position and varying the IGV setting angle during tests.

At both the 100 and 120 percent of design speeds, the pressure ratio and flow increase as the inlet guide vane setting angle is changed from 42.5° to -17.5°. However, a change in the flow characteristics is apparent as the setting angle is further changed to -25°. At design speed the flow-pressure ratio curve for -25° is essentially the same as that for -17.5° except near the stall line. The data presented were corrected to standard-day conditions at the IGV inlet. Had the data been corrected to rotor-inlet conditions, the flow-pressure ratio curve for -25° would not have been the same as that for -17.5°. At a setting angle of -25° the pressure losses across the IGV are considerably greater than those at -17.5°. For equivalent IGV inlet flows, the rotor will be operating at a higher corrected airflow at an angle of -25° than at -17.5°.

At 120 percent design speed the flow-pressure ratio curve for -25° has dropped and is between those at the 0° and -10° angles. Preliminary survey data at 120 percent design speed (not presented in this report) indicate that the rotor tip element is choked even at a setting angle of 0°. Turning the inlet guide vanes to more negative angles caused this choked region to move further down the rotor blades.

There is a considerable variation in peak efficiency over the range of vane setting angles. At 42.5° the design speed peak efficiency is 0.676. It continues to increase to a maximum of 0.892 at 0° and then decreases to 0.795 at -25°. There is a similar change in peak efficiency at 120 percent of design speed; however, the maximum value occurs at an angle of 10°.

Based on the operating line presented, the useful range of inlet-guide-vane setting angle is limited: At the high negative angles, the stage choked; at the high positive angles, the stage stalled.

Calculated Thrust

The primary purpose of the variable inlet guide vane in this fan stage is to provide thrust modulation capability at constant blade speed. The effect of vane-angle variation on the calculated static thrust is presented in figure 10. Maximum calculated static thrust and operating line static thrust are presented for both the 100 and 120 percent of design speeds.

At 100 percent of design speed (fig. 10(a)) the operating-line static thrust is nearly equal to maximum values except at the higher negative vane setting angles. At 120 percent of design speed the differences are more significant over the setting angle range. At design speed the operating line calculated static thrust varied from 3900 to 6500 newtons, which corresponds to 68 to 114 percent of that obtained at 0° as the inlet guide vane angle was changed from 32.5° to -17.5°. The lower limit was due to the operating line crossing the stall line and the upper limit was set by choking. In the application of this stage in an engine, a variable area exit nozzle would probably be required to achieve a wider range of thrust. At the more negative angles, more thrust could be realized by reducing the area (and flow); while at the more positive angles, increasing the area would move the operating line away from stall and would allow for further reductions in thrust.

SUMMARY OF RESULTS

The overall performance of a fan stage suitable for vertical-lift aircraft and incorporating variable inlet guide vanes was determined for nine vane setting angles. Data were obtained over the stable flow range at rotative speeds from 60 to 120 percent of design. The vane angle was varied from 42.5° to -25°. The following were the principal results of the investigation:

1. At the design speed and the design inlet guide vane angle, the stage had a peak efficiency of 0.892 at a pressure ratio of 1.322 and a flow of 25.31 kilograms per second. The stall margin based on peak efficiency and stall was 20 percent.

2. Based on an operating line passing through the peak efficient point at the design vane setting angle, the useful operating range of the stage at design speed is limited by stall at the high positive setting angles (32.5°) and by choke at high negative setting angles (-17.5°).

3. At design speed the calculated static thrust along an operating line varied from 68 to 114 percent of that obtained at a vane angle of 0° as the inlet guide vanes were changed from 32.5° to -17.5°.

Lewis Research Center,
National Aeronautics and Space Administration,
Cleveland, Ohio, May 9, 1979,
505-04.

APPENDIX A

SYMBOLS

A	area, m^2
A_{an}	annulus area at inlet guide vane leading edge, m^2
A_f	frontal area at inlet guide vane leading edge, m^2
C_p	specific heat at constant pressure, 1004 J/kg K
N	rotative speed, rpm
P	total pressure, N/cm^2
p	static pressure, N/cm^2
SM	stall margin
T	total temperature, K
U	wheel speed, m/sec
V	air speed, m/sec
W	airflow, kg/sec
γ	ratio of specific heats
δ	ratio of inlet guide vane inlet total pressure to standard pressure of $10.13\ N/cm^2$
η	efficiency
θ	ratio of inlet guide vane inlet total temperature to standard temperature at 288.2 K
ρ	density, kg/sec

Subscripts:

ad	adiabatic
LE	blade leading edge
mom	momentum-rise
TE	blade trailing edge
z	axial direction
θ	tangential direction

Definitions and Units Used in Tables:

AREA	area, m^2
AIRFLOW	equivalent airflow, kg/sec
ROTATIVE SPEED	rotative speed, rpm

APPENDIX B

EQUATIONS

Adiabatic (temperature rise) efficiency -

$$\eta_{ad} = \frac{\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1}{\frac{T_{TE}}{T_{LE}} - 1} \tag{B1}$$

Momentum-rise efficiency -

$$\eta_{mom} = \frac{\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1}{\frac{(UV_\theta)_{TE} - (UV_\theta)_{LE}}{T_{LE}C_p}} \tag{B2}$$

Equivalent airflow -

$$\frac{W\sqrt{\theta}}{\delta} \tag{B3}$$

Equivalent rotative speed -

$$\frac{N}{\sqrt{\theta}} \tag{B4}$$

Airflow per unit annulus area -

$$\frac{\left(\frac{W\sqrt{\theta}}{\delta}\right)}{A_{an}} \tag{B5}$$

Airflow per unit frontal area -

$$\frac{\left(\frac{W\sqrt{\theta}}{\delta}\right)}{A_f} \tag{B6}$$

Head-rise coefficient -

$$\frac{C_p T_{LE}}{U_{tip}^2}\left[\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1\right] \tag{B7}$$

Flow coefficient -

$$\left(\frac{V_z}{U_{tip}}\right)_{LE} \tag{B8}$$

Stall margin -

$$SM = \left[\frac{\left(\frac{P_{TE}}{P_{LE}}\right)_{stall}}{\left(\frac{P_{TE}}{P_{LE}}\right)_{ref}} \times \frac{\left(\frac{W\sqrt{\theta}}{\delta}\right)_{ref}}{\left(\frac{W\sqrt{\theta}}{\delta}\right)_{stall}} - 1\right] \times 100 \tag{B9}$$

Static thrust -

$$\rho V_z^2 A_{TE} + (p_{TE} - P_{LE}) A_{TE} \tag{B10}$$

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TABLE I. - OVERALL PERFORMANCE OF STAGE 57M2A

(a) 120 Percent of design speed

READING NUMBER	0461	0460	0459	0458	0457
IGV TOTAL PRESSURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL PRESSURE RATIO	1.587	1.529	1.457	1.367	1.310
STATOR TOTAL PRESSURE RATIO	0.981	0.995	0.991	0.980	0.967
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.166	1.156	1.143	1.125	1.116
STATOR TOTAL TEMPERATURE RATIO	0.995	0.995	0.995	0.996	0.995
ROTOR ADIABATIC EFFICIENCY	0.849	0.826	0.796	0.746	0.688
ROTOR MOMENTUM-RISE EFFICIENCY	0.894	0.876	0.832	0.765	0.718
ROTOR HEAD-RISE COEFFICIENT	0.394	0.354	0.308	0.250	0.213
FLOW COEFFICIENT	0.371	0.395	0.407	0.409	0.410
AIRFLOW PER UNIT FRONTAL AREA	133.33	140.60	144.42	145.07	145.23
AIRFLOW PER UNIT ANNULUS AREA	145.67	153.61	157.79	158.50	158.67
AIRFLOW AT ORIFICE	27.02	28.50	29.27	29.40	29.44
AIRFLOW AT IGV INLET	27.00	28.55	29.23	29.38	29.39
AIRFLOW AT ROTOR INLET	27.11	28.66	29.31	29.41	29.45
AIRFLOW AT ROTOR OUTLET	25.86	27.54	28.58	28.83	29.06
AIRFLOW AT STATOR OUTLET	27.27	28.76	29.23	28.86	29.09
ROTATIVE SPEED	13079.7	13141.7	13133.1	13122.0	13097.1
PERCENT OF DESIGN SPEED	120.2	120.7	120.6	120.5	120.3
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.555	1.520	1.442	1.338	1.265
STAGE TOTAL TEMPERATURE RATIO	1.160	1.149	1.136	1.121	1.110
STAGE ADIABATIC EFFICIENCY	0.842	0.851	0.811	0.718	0.634

(b) 110 Percent of design speed

READING NUMBER	0456	0454	0453	0451	0450
IGV TOTAL PRESSURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL PRESSURE RATIO	1.489	1.453	1.412	1.323	1.266
STATOR TOTAL PRESSURE RATIO	0.980	0.989	0.990	0.984	0.970
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	1.000	1.000	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.138	1.130	1.123	1.105	1.097
STATOR TOTAL TEMPERATURE RATIO	0.996	0.993	0.995	0.997	0.995
ROTOR ADIABATIC EFFICIENCY	0.876	0.863	0.844	0.791	0.720
ROTOR MOMENTUM-RISE EFFICIENCY	0.920	0.931	0.902	0.811	0.752
ROTOR HEAD-RISE COEFFICIENT	0.390	0.364	0.332	0.263	0.219
FLOW COEFFICIENT	0.362	0.399	0.416	0.427	0.429
AIRFLOW PER UNIT FRONTAL AREA	120.99	131.09	136.19	139.69	139.84
AIRFLOW PER UNIT ANNULUS AREA	132.19	143.23	148.80	152.62	152.79
AIRFLOW AT ORIFICE	24.52	26.57	27.60	28.31	28.34
AIRFLOW AT IGV INLET	24.49	26.58	27.61	28.22	28.27
AIRFLOW AT ROTOR INLET	24.55	26.63	27.62	28.28	28.33
AIRFLOW AT ROTOR OUTLET	23.74	25.81	26.92	27.63	27.97
AIRFLOW AT STATOR OUTLET	24.44	26.34	27.24	27.56	27.71
ROTATIVE SPEED	11987.7	11962.0	11973.7	11968.9	11956.4
PERCENT OF DESIGN SPEED	110.1	109.9	110.0	109.9	109.8
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.458	1.435	1.396	1.300	1.227
STAGE TOTAL TEMPERATURE RATIO	1.133	1.123	1.117	1.102	1.091
STAGE ADIABATIC EFFICIENCY	0.858	0.885	0.857	0.765	0.662

(c) 100 Percent of design speed

READING NUMBER	0449	0448	0447	0446	0445
IGV TOTAL PRESSURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL PRESSURE RATIO	1.380	1.361	1.338	1.302	1.226
STATOR TOTAL PRESSURE RATIO	0.986	0.989	0.989	0.982	0.972
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	0.999	0.999	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.111	1.104	1.098	1.090	1.079
STATOR TOTAL TEMPERATURE RATIO	0.996	0.996	0.996	0.996	0.996
ROTOR ADIABATIC EFFICIENCY	0.869	0.885	0.883	0.874	0.761
ROTOR MOMENTUM-RISE EFFICIENCY	0.920	0.945	0.940	0.905	0.791
ROTOR HEAD-RISE COEFFICIENT	0.371	0.353	0.330	0.295	0.223
FLOW COEFFICIENT	0.358	0.392	0.415	0.445	0.453
AIRFLOW PER UNIT FRONTAL AREA	109.70	118.65	124.87	132.90	135.60
AIRFLOW PER UNIT ANNULUS AREA	119.85	129.63	136.44	145.20	148.15
AIRFLOW AT ORIFICE	22.23	24.05	25.31	26.94	27.48
AIRFLOW AT IGV INLET	22.24	24.06	25.32	26.94	27.40
AIRFLOW AT ROTOR INLET	22.22	24.06	25.35	26.95	27.43
AIRFLOW AT ROTOR OUTLET	21.52	23.52	24.83	26.50	26.84
AIRFLOW AT STATOR OUTLET	21.96	23.62	24.74	26.16	26.67
ROTATIVE SPEED	10868.6	10858.5	10863.8	10876.6	10893.9
PERCENT OF DESIGN SPEED	99.8	99.7	99.8	99.9	100.1
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.359	1.344	1.322	1.277	1.191
STAGE TOTAL TEMPERATURE RATIO	1.106	1.099	1.093	1.085	1.074
STAGE ADIABATIC EFFICIENCY	0.862	0.891	0.892	0.851	0.693

TABLE I. - Continued. OVERALL PERFORMANCE OF STAGE 57M2A

(d) 90 Percent of design speed

READING NUMBER	0466	0465	0464	0463	0462
IGV TOTAL PRESSURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL PRESSURE RATIO	1.295	1.278	1.256	1.235	1.189
STATOR TOTAL PRESSURE RATIO	0.989	0.992	0.992	0.988	0.976
IGV TOTAL TEMPERATURE RATIO	1.000	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.089	1.082	1.075	1.069	1.063
STATOR TOTAL TEMPERATURE RATIO	0.997	0.998	0.998	0.998	0.997
ROTOR ADIABATIC EFFICIENCY	0.865	0.888	0.899	0.898	0.810
ROTOR MOMENTUM-RISE EFFICIENCY	0.924	0.945	0.952	0.939	0.854
ROTOR HEAD-RISE COEFFICIENT	0.360	0.339	0.312	0.286	0.232
FLOW COEFFICIENT	0.347	0.383	0.417	0.446	0.478
AIRFLOW PER UNIT FRONTAL AREA	96.44	105.44	114.03	121.13	128.83
AIRFLOW PER UNIT ANNULUS AREA	105.37	115.20	124.58	132.34	140.75
AIRFLOW AT ORIFICE	19.55	21.37	23.11	24.55	26.11
AIRFLOW AT IGV INLET	19.57	21.36	23.11	24.53	26.03
AIRFLOW AT ROTOR INLET	19.54	21.36	23.12	24.53	26.07
AIRFLOW AT ROTOR OUTLET	19.03	20.82	22.67	24.09	25.48
AIRFLOW AT STATOR OUTLET	19.38	21.01	22.61	23.90	25.35
ROTATIVE SPEED	9749.3	9735.7	9740.1	9747.6	9736.0
PERCENT OF DESIGN SPEED	89.6	89.4	89.5	89.5	89.4
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.280	1.268	1.245	1.218	1.159
STAGE TOTAL TEMPERATURE RATIO	1.085	1.079	1.072	1.066	1.058
STAGE ADIABATIC EFFICIENCY	0.859	0.893	0.900	0.876	0.742

(e) 80 Percent of design speed

READING NUMBER	0471	0470	0469	0468	0467
IGV TOTAL PRESSURE RATIO	1.000	0.999	0.999	0.999	0.999
ROTOR TOTAL PRESSURE RATIO	1.228	1.214	1.194	1.177	1.153
STATOR TOTAL PRESSURE RATIO	0.992	0.992	0.990	0.984	0.976
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	1.000	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.070	1.063	1.057	1.053	1.048
STATOR TOTAL TEMPERATURE RATIO	0.998	0.998	0.998	0.997	0.997
ROTOR ADIABATIC EFFICIENCY	0.869	0.900	0.907	0.903	0.859
ROTOR MOMENTUM-RISE EFFICIENCY	0.930	0.963	0.963	0.954	0.910
ROTOR HEAD-RISE COEFFICIENT	0.349	0.327	0.297	0.272	0.236
FLOW COEFFICIENT	0.345	0.388	0.425	0.458	0.490
AIRFLOW PER UNIT FRONTAL AREA	86.30	96.28	104.71	111.95	119.04
AIRFLOW PER UNIT ANNULUS AREA	94.29	105.19	114.40	122.31	130.05
AIRFLOW AT ORIFICE	17.49	19.52	21.22	22.69	24.13
AIRFLOW AT IGV INLET	17.47	19.51	21.22	22.67	24.08
AIRFLOW AT ROTOR INLET	17.46	19.49	21.19	22.66	24.08
AIRFLOW AT ROTOR OUTLET	16.92	19.12	20.87	22.39	23.67
AIRFLOW AT STATOR OUTLET	17.19	18.97	20.54	21.83	23.23
ROTATIVE SPEED	8701.3	8707.3	8706.8	8689.7	8691.4
PERCENT OF DESIGN SPEED	79.9	80.0	80.0	79.8	79.8
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.217	1.204	1.182	1.157	1.124
STAGE TOTAL TEMPERATURE RATIO	1.067	1.061	1.055	1.049	1.044
STAGE ADIABATIC EFFICIENCY	0.866	0.893	0.893	0.862	0.766

(f) 70 Percent of design speed

READING NUMBER	0477	0476	0475	0474	0473
IGV TOTAL PRESSURE RATIO	1.000	1.000	0.999	0.999	0.999
ROTOR TOTAL PRESSURE RATIO	1.169	1.159	1.143	1.129	1.111
STATOR TOTAL PRESSURE RATIO	0.994	0.995	0.991	0.987	0.981
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	1.000	1.000	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.052	1.048	1.043	1.039	1.036
STATOR TOTAL TEMPERATURE RATIO	0.998	0.999	0.998	0.998	0.998
ROTOR ADIABATIC EFFICIENCY	0.875	0.901	0.916	0.901	0.858
ROTOR MOMENTUM-RISE EFFICIENCY	0.941	0.970	0.979	0.963	0.927
ROTOR HEAD-RISE COEFFICIENT	0.339	0.318	0.287	0.259	0.224
FLOW COEFFICIENT	0.343	0.383	0.429	0.464	0.500
AIRFLOW PER UNIT FRONTAL AREA	75.35	83.83	93.17	100.18	107.60
AIRFLOW PER UNIT ANNULUS AREA	82.33	91.59	101.79	109.46	117.56
AIRFLOW AT ORIFICE	15.27	16.99	18.88	20.31	21.81
AIRFLOW AT IGV INLET	15.31	16.99	18.91	20.29	21.79
AIRFLOW AT ROTOR INLET	15.28	16.98	18.88	20.28	21.77
AIRFLOW AT ROTOR OUTLET	14.82	16.61	18.66	19.96	21.28
AIRFLOW AT STATOR OUTLET	15.00	16.52	18.28	19.52	21.00
ROTATIVE SPEED	7611.1	7608.9	7603.2	7600.8	7607.8
PERCENT OF DESIGN SPEED	69.9	69.9	69.8	69.8	69.9
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.161	1.152	1.132	1.113	1.090
STAGE TOTAL TEMPERATURE RATIO	1.050	1.046	1.040	1.037	1.033
STAGE ADIABATIC EFFICIENCY	0.866	0.895	0.892	0.850	0.748

TABLE I. - Concluded. OVERALL PERFORMANCE OF STAGE 57M2A

(g) 60 Percent of design speed

READING NUMBER	0481	0480	0479	0478
IGV TOTAL PRESSURE RATIO	1.000	1.000	0.999	0.999
ROTOR TOTAL PRESSURE RATIO	1.122	1.109	1.095	1.078
STATOR TOTAL PRESSURE RATIO	0.995	0.995	0.991	0.984
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	1.000	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.038	1.033	1.029	1.025
STATOR TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999
ROTOR ADIABATIC EFFICIENCY	0.877	0.914	0.915	0.867
ROTOR MOMENTUM-RISE EFFICIENCY	0.948	1.000	0.993	0.955
ROTOR HEAD-RISE COEFFICIENT	0.332	0.298	0.259	0.213
FLOW COEFFICIENT	0.336	0.404	0.457	0.513
AIRFLOW PER UNIT FRONTAL AREA	63.68	76.15	85.79	95.35
AIRFLOW PER UNIT ANNULUS AREA	69.57	83.20	93.73	104.17
AIRFLOW AT ORIFICE	12.91	15.43	17.39	19.33
AIRFLOW AT IGV INLET	12.94	15.46	17.40	19.31
AIRFLOW AT ROTOR INLET	12.91	15.42	17.37	19.27
AIRFLOW AT ROTOR OUTLET	12.50	15.23	17.11	18.84
AIRFLOW AT STATOR OUTLET	12.67	14.96	16.73	18.59
ROTATIVE SPEED	6534.2	6522.9	6534.0	6514.1
PERCENT OF DESIGN SPEED	60.0	59.9	60.0	59.8
COMPRESSOR PERFORMANCE				
STAGE TOTAL PRESSURE RATIO	1.116	1.103	1.084	1.060
STAGE TOTAL TEMPERATURE RATIO	1.037	1.031	1.027	1.023
STAGE ADIABATIC EFFICIENCY	0.860	0.902	0.859	0.714

TABLE II. - OVERALL PERFORMANCE OF STAGE 57M2B

(a) 120 Percent of design speed

READING NUMBER	0506	0502	0503	0501	0500	0499
IGV TOTAL PRESSURE RATIO	0.998	0.998	0.998	0.998	0.998	0.998
ROTOR TOTAL PRESSURE RATIO	1.582	1.572	1.557	1.489	1.419	1.350
STATOR TOTAL PRESSURE RATIO	0.990	0.991	0.987	0.981	0.978	0.943
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.173	1.170	1.167	1.156	1.144	1.134
STATOR TOTAL TEMPERATURE RATIO	0.996	0.996	0.996	0.996	0.995	0.993
ROTOR ADIABATIC EFFICIENCY	0.811	0.810	0.807	0.773	0.731	0.667
ROTOR MOMENTUM-RISE EFFICIENCY	0.837	0.838	0.840	0.796	0.748	0.703
ROTOR HEAD-RISE COEFFICIENT	0.394	0.387	0.377	0.332	0.288	0.243
FLOW COEFFICIENT	0.396	0.404	0.416	0.421	0.423	0.424
AIRFLOW PER UNIT FRONTAL AREA	140.12	142.54	146.45	148.33	148.66	148.94
AIRFLOW PER UNIT ANNULUS AREA	153.09	155.73	160.00	162.06	162.42	162.72
AIRFLOW AT ORIFICE	28.40	28.89	29.68	30.06	30.13	30.19
AIRFLOW AT IGV INLET	28.45	28.91	29.66	29.96	30.04	30.10
AIRFLOW AT ROTOR INLET	28.68	29.16	29.89	30.17	30.25	30.30
AIRFLOW AT ROTOR OUTLET	27.85	28.43	29.55	29.89	30.07	30.39
AIRFLOW AT STATOR OUTLET	28.96	29.38	29.80	29.47	29.17	30.39
ROTATIVE SPEED	13057.6	13068.8	13077.2	13080.0	13061.5	13059.4
PERCENT OF DESIGN SPEED	119.9	120.1	120.1	120.2	120.0	120.0
COMPRESSOR PERFORMANCE						
STAGE TOTAL PRESSURE RATIO	1.563	1.555	1.533	1.458	1.374	1.271
STAGE TOTAL TEMPERATURE RATIO	1.168	1.165	1.162	1.150	1.138	1.125
STAGE ADIABATIC EFFICIENCY	0.811	0.813	0.802	0.757	0.690	0.565

(b) 110 Percent of design speed

READING NUMBER	0498	0497	0496	0495	0494
IGV TOTAL PRESSURE RATIO	0.999	0.998	0.998	0.998	0.998
ROTOR TOTAL PRESSURE RATIO	1.535	1.504	1.444	1.364	1.317
STATOR TOTAL PRESSURE RATIO	0.980	0.989	0.982	0.969	0.945
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	1.000	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.151	1.145	1.132	1.121	1.113
STATOR TOTAL TEMPERATURE RATIO	0.996	0.996	0.997	0.996	0.995
ROTOR ADIABATIC EFFICIENCY	0.865	0.855	0.835	0.768	0.728
ROTOR MOMENTUM-RISE EFFICIENCY	0.893	0.889	0.856	0.796	0.753
ROTOR HEAD-RISE COEFFICIENT	0.427	0.404	0.357	0.297	0.260
FLOW COEFFICIENT	0.381	0.416	0.438	0.445	0.446
AIRFLOW PER UNIT FRONTAL AREA	126.57	136.15	142.47	144.44	144.82
AIRFLOW PER UNIT ANNULUS AREA	138.29	148.74	155.66	157.81	158.22
AIRFLOW AT ORIFICE	25.65	27.59	28.88	29.28	29.35
AIRFLOW AT IGV INLET	25.62	27.57	28.83	29.17	29.25
AIRFLOW AT ROTOR INLET	25.83	27.77	29.01	29.36	29.44
AIRFLOW AT ROTOR OUTLET	25.44	27.14	28.61	28.97	29.74
AIRFLOW AT STATOR OUTLET	25.63	27.57	27.97	28.13	29.10
ROTATIVE SPEED	11980.8	11964.4	11987.6	11965.0	11979.2
PERCENT OF DESIGN SPEED	110.1	109.9	110.1	109.9	110.0
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.502	1.485	1.415	1.319	1.243
STAGE TOTAL TEMPERATURE RATIO	1.146	1.139	1.128	1.115	1.106
STAGE ADIABATIC EFFICIENCY	0.841	0.859	0.812	0.718	0.608

(c) 100 Percent of design speed

READING NUMBER	0492	0491	0490	0489	0488
IGV TOTAL PRESSURE RATIO	0.999	0.999	0.998	0.998	0.998
ROTOR TOTAL PRESSURE RATIO	1.413	1.412	1.383	1.322	1.271
STATOR TOTAL PRESSURE RATIO	0.989	0.987	0.985	0.976	0.951
IGV TOTAL TEMPERATURE RATIO	1.000	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.119	1.116	1.109	1.101	1.093
STATOR TOTAL TEMPERATURE RATIO	0.998	0.997	0.998	0.997	0.996
ROTOR ADIABATIC EFFICIENCY	0.873	0.896	0.894	0.819	0.762
ROTOR MOMENTUM-RISE EFFICIENCY	0.898	0.930	0.918	0.846	0.778
ROTOR HEAD-RISE COEFFICIENT	0.400	0.398	0.371	0.315	0.266
FLOW COEFFICIENT	0.379	0.416	0.445	0.466	0.469
AIRFLOW PER UNIT FRONTAL AREA	115.71	125.67	133.34	138.66	139.60
AIRFLOW PER UNIT ANNULUS AREA	126.42	137.31	145.68	151.49	152.51
AIRFLOW AT ORIFICE	23.45	25.47	27.03	28.10	28.29
AIRFLOW AT IGV INLET	23.43	25.42	26.97	28.03	28.21
AIRFLOW AT ROTOR INLET	23.53	25.57	27.13	28.19	28.34
AIRFLOW AT ROTOR OUTLET	22.91	25.23	26.76	27.64	28.47
AIRFLOW AT STATOR OUTLET	23.16	25.04	26.15	27.04	27.64
ROTATIVE SPEED	10898.7	10895.4	10898.2	10886.0	10900.9
PERCENT OF DESIGN SPEED	100.1	100.1	100.1	100.0	100.1
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.396	1.392	1.360	1.288	1.206
STAGE TOTAL TEMPERATURE RATIO	1.117	1.112	1.106	1.097	1.088
STAGE ADIABATIC EFFICIENCY	0.857	0.886	0.866	0.771	0.624

TABLE II. - Concluded. OVERALL PERFORMANCE OF STAGE 57M2B

(d) 90 Percent of design speed

READING NUMBER	0507
IGV TOTAL PRESSURE RATIO	0.999
ROTOR TOTAL PRESSURE RATIO	1.317
STATOR TOTAL PRESSURE RATIO	0.991
IGV TOTAL TEMPERATURE RATIO	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.096
STATOR TOTAL TEMPERATURE RATIO	0.998
ROTOR ADIABATIC EFFICIENCY	0.854
ROTOR MOMENTUM-RISE EFFICIENCY	0.898
ROTOR HEAD-RISE COEFFICIENT	0.383
FLOW COEFFICIENT	0.364
AIRFLOW PER UNIT FRONTAL AREA	101.10
AIRFLOW PER UNIT ANNULUS AREA	110.45
AIRFLOW AT ORIFICE	20.49
AIRFLOW AT IGV INLET	20.48
AIRFLOW AT ROTOR INLET	20.59
AIRFLOW AT ROTOR OUTLET	20.11
AIRFLOW AT STATOR OUTLET	20.24
ROTATIVE SPEED	9779.5
PERCENT OF DESIGN SPEED	89.8
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.304
STAGE TOTAL TEMPERATURE RATIO	1.093
STAGE ADIABATIC EFFICIENCY	0.849

(e) 80 Percent of design speed

READING NUMBER	0508
IGV TOTAL PRESSURE RATIO	0.999
ROTOR TOTAL PRESSURE RATIO	1.246
STATOR TOTAL PRESSURE RATIO	0.991
IGV TOTAL TEMPERATURE RATIO	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.075
STATOR TOTAL TEMPERATURE RATIO	0.999
ROTOR ADIABATIC EFFICIENCY	0.864
ROTOR MOMENTUM-RISE EFFICIENCY	0.905
ROTOR HEAD-RISE COEFFICIENT	0.374
FLOW COEFFICIENT	0.359
AIRFLOW PER UNIT FRONTAL AREA	89.77
AIRFLOW PER UNIT ANNULUS AREA	98.08
AIRFLOW AT ORIFICE	18.20
AIRFLOW AT IGV INLET	18.20
AIRFLOW AT ROTOR INLET	18.29
AIRFLOW AT ROTOR OUTLET	18.00
AIRFLOW AT STATOR OUTLET	17.88
ROTATIVE SPEED	8733.8
PERCENT OF DESIGN SPEED	80.2
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.234
STAGE TOTAL TEMPERATURE RATIO	1.073
STAGE ADIABATIC EFFICIENCY	0.845

(f) 70 Percent of design speed

READING NUMBER	0513	0512	0511	0510	0509
IGV TOTAL PRESSURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL PRESSURE RATIO	1.181	1.173	1.160	1.150	1.139
STATOR TOTAL PRESSURE RATIO	0.993	0.993	0.991	0.981	0.968
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	1.000	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.056	1.052	1.049	1.046	1.043
STATOR TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.998	0.999
ROTOR ADIABATIC EFFICIENCY	0.870	0.895	0.892	0.892	0.882
ROTOR MOMENTUM-RISE EFFICIENCY	0.918	0.952	0.960	0.960	0.946
ROTOR HEAD-RISE COEFFICIENT	0.363	0.347	0.321	0.299	0.278
FLOW COEFFICIENT	0.363	0.405	0.448	0.488	0.525
AIRFLOW PER UNIT FRONTAL AREA	79.72	88.63	97.22	105.42	112.73
AIRFLOW PER UNIT ANNULUS AREA	87.09	96.83	106.22	115.17	123.16
AIRFLOW AT ORIFICE	16.16	17.96	19.71	21.37	22.85
AIRFLOW AT IGV INLET	16.15	17.93	19.71	21.31	22.79
AIRFLOW AT ROTOR INLET	16.24	18.03	19.80	21.42	22.87
AIRFLOW AT ROTOR OUTLET	15.93	17.74	19.32	21.12	22.75
AIRFLOW AT STATOR OUTLET	15.78	17.28	18.95	20.34	21.96
ROTATIVE SPEED	7614.4	7618.1	7624.1	7620.1	7613.7
PERCENT OF DESIGN SPEED	69.9	70.0	70.0	70.0	69.9
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.172	1.164	1.149	1.127	1.102
STAGE TOTAL TEMPERATURE RATIO	1.054	1.051	1.047	1.043	1.041
STAGE ADIABATIC EFFICIENCY	0.855	0.879	0.865	0.800	0.685

(g) 60 Percent of design speed

READING NUMBER	0514
IGV TOTAL PRESSURE RATIO	1.000
ROTOR TOTAL PRESSURE RATIO	1.130
STATOR TOTAL PRESSURE RATIO	0.995
IGV TOTAL TEMPERATURE RATIO	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.040
STATOR TOTAL TEMPERATURE RATIO	0.999
ROTOR ADIABATIC EFFICIENCY	0.880
ROTOR MOMENTUM-RISE EFFICIENCY	0.926
ROTOR HEAD-RISE COEFFICIENT	0.349
FLOW COEFFICIENT	0.369
AIRFLOW PER UNIT FRONTAL AREA	70.34
AIRFLOW PER UNIT ANNULUS AREA	76.85
AIRFLOW AT ORIFICE	14.26
AIRFLOW AT IGV INLET	14.28
AIRFLOW AT ROTOR INLET	14.38
AIRFLOW AT ROTOR OUTLET	14.03
AIRFLOW AT STATOR OUTLET	13.81
ROTATIVE SPEED	6582.0
PERCENT OF DESIGN SPEED	60.5
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.124
STAGE TOTAL TEMPERATURE RATIO	1.040
STAGE ADIABATIC EFFICIENCY	0.860

TABLE III. - OVERALL PERFORMANCE OF STAGE 57M2C

(a) 120 Percent of design speed

READING NUMBER	0554	0553	0552	0551	0550
IGV TOTAL PRESSURE RATIO	0.992	0.989	0.988	0.988	0.988
ROTOR TOTAL PRESSURE RATIO	1.602	1.572	1.514	1.463	1.406
STATOR TOTAL PRESSURE RATIO	0.968	0.975	0.958	0.943	0.929
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.998	0.998	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.187	1.178	1.169	1.159	1.148
STATOR TOTAL TEMPERATURE RATIO	0.996	0.996	0.993	0.993	0.996
ROTOR ADIABATIC EFFICIENCY	0.770	0.775	0.747	0.720	0.693
ROTOR MOMENTUM-RISE EFFICIENCY	0.806	0.796	0.769	0.739	0.708
ROTOR HEAD-RISE COEFFICIENT	0.410	0.389	0.355	0.321	0.282
FLOW COEFFICIENT	0.401	0.424	0.427	0.428	0.429
AIRFLOW PER UNIT FRONTAL AREA	142.19	148.73	149.59	150.04	150.19
AIRFLOW PER UNIT ANNULUS AREA	155.35	162.50	163.43	163.93	164.09
AIRFLOW AT ORIFICE	28.82	30.15	30.32	30.41	30.44
AIRFLOW AT IGV INLET	28.78	30.11	30.21	30.28	30.33
AIRFLOW AT ROTOR INLET	28.95	30.12	30.25	30.33	30.36
AIRFLOW AT ROTOR OUTLET	28.31	30.04	30.62	31.30	31.25
AIRFLOW AT STATOR OUTLET	29.16	29.62	29.17	29.25	30.56
ROTATIVE SPEED	13062.3	13058.9	13017.5	13018.9	13035.4
PERCENT OF DESIGN SPEED	120.0	120.0	119.6	119.6	119.7
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.570	1.515	1.433	1.364	1.291
STAGE TOTAL TEMPERATURE RATIO	1.181	1.172	1.159	1.150	1.142
STAGE ADIABATIC EFFICIENCY	0.761	0.733	0.682	0.620	0.532

(b) 110 Percent of design speed

READING NUMBER	0526	0525	0524	0523	0522
IGV TOTAL PRESSURE RATIO	0.994	0.992	0.991	0.990	0.989
ROTOR TOTAL PRESSURE RATIO	1.528	1.513	1.474	1.421	1.360
STATOR TOTAL PRESSURE RATIO	0.994	0.987	0.975	0.957	0.936
IGV TOTAL TEMPERATURE RATIO	1.000	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.159	1.154	1.148	1.138	1.128
STATOR TOTAL TEMPERATURE RATIO	0.997	0.997	0.995	0.995	0.996
ROTOR ADIABATIC EFFICIENCY	0.812	0.816	0.795	0.766	0.719
ROTOR MOMENTUM-RISE EFFICIENCY	0.849	0.847	0.829	0.800	0.759
ROTOR HEAD-RISE COEFFICIENT	0.426	0.414	0.384	0.344	0.296
FLOW COEFFICIENT	0.411	0.434	0.449	0.452	0.454
AIRFLOW PER UNIT FRONTAL AREA	134.82	141.01	145.32	146.37	146.83
AIRFLOW PER UNIT ANNULUS AREA	147.29	154.06	158.77	159.91	160.42
AIRFLOW AT ORIFICE	27.33	28.58	29.46	29.67	29.76
AIRFLOW AT IGV INLET	27.31	28.57	29.36	29.54	29.66
AIRFLOW AT ROTOR INLET	27.52	28.74	29.50	29.66	29.75
AIRFLOW AT ROTOR OUTLET	26.19	27.79	29.01	30.02	30.32
AIRFLOW AT STATOR OUTLET	27.30	28.09	28.43	28.43	30.04
ROTATIVE SPEED	11973.7	11971.4	11968.3	11951.3	11964.9
PERCENT OF DESIGN SPEED	110.0	110.0	109.9	109.8	109.9
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.510	1.482	1.424	1.347	1.260
STAGE TOTAL TEMPERATURE RATIO	1.155	1.149	1.141	1.131	1.122
STAGE ADIABATIC EFFICIENCY	0.805	0.797	0.753	0.677	0.559

(c) 100 Percent of design speed

READING NUMBER	0521	0520	0519	0518	0517
IGV TOTAL PRESSURE RATIO	0.997	0.995	0.994	0.993	0.992
ROTOR TOTAL PRESSURE RATIO	1.440	1.446	1.418	1.370	1.314
STATOR TOTAL PRESSURE RATIO	0.987	0.990	0.988	0.968	0.946
IGV TOTAL TEMPERATURE RATIO	0.999	1.000	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.129	1.128	1.122	1.115	1.105
STATOR TOTAL TEMPERATURE RATIO	0.998	0.997	0.998	0.996	0.998
ROTOR ADIABATIC EFFICIENCY	0.849	0.870	0.858	0.818	0.774
ROTOR MOMENTUM-RISE EFFICIENCY	0.886	0.910	0.895	0.855	0.813
ROTOR HEAD-RISE COEFFICIENT	0.429	0.434	0.407	0.363	0.310
FLOW COEFFICIENT	0.390	0.432	0.457	0.478	0.482
AIRFLOW PER UNIT FRONTAL AREA	118.56	129.57	136.38	141.41	142.51
AIRFLOW PER UNIT ANNULUS AREA	129.53	141.56	149.00	154.50	155.69
AIRFLOW AT ORIFICE	24.03	26.26	27.64	28.66	28.88
AIRFLOW AT IGV INLET	23.98	26.23	27.56	28.57	28.80
AIRFLOW AT ROTOR INLET	24.13	26.37	27.73	28.72	28.96
AIRFLOW AT ROTOR OUTLET	23.71	25.58	26.88	28.32	28.99
AIRFLOW AT STATOR OUTLET	23.77	25.86	26.73	27.40	28.76
ROTATIVE SPEED	10868.8	10873.7	10876.0	10866.4	10885.8
PERCENT OF DESIGN SPEED	99.8	99.9	99.9	99.8	100.0
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.417	1.426	1.393	1.317	1.234
STAGE TOTAL TEMPERATURE RATIO	1.126	1.123	1.119	1.110	1.101
STAGE ADIABATIC EFFICIENCY	0.833	0.864	0.833	0.742	0.611

TABLE III. - Continued. OVERALL PERFORMANCE OF STAGE 57M2C

(d) 90 Percent of design speed

READING NUMBER	0547	0546	0545	0544	0543
IGV TOTAL PRESSURE RATIO	0.997	0.997	0.995	0.994	0.994
ROTOR TOTAL PRESSURE RATIO	1.338	1.343	1.324	1.302	1.264
STATOR TOTAL PRESSURE RATIO	0.990	0.987	0.983	0.964	0.945
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.103	1.099	1.094	1.091	1.086
STATOR TOTAL TEMPERATURE RATIO	0.998	0.998	0.998	0.997	0.998
ROTOR ADIABATIC EFFICIENCY	0.844	0.886	0.884	0.858	0.809
ROTOR MOMENTUM-RISE EFFICIENCY	0.882	0.921	0.931	0.900	0.860
ROTOR HEAD-RISE COEFFICIENT	0.407	0.409	0.389	0.362	0.320
FLOW COEFFICIENT	0.388	0.429	0.474	0.504	0.512
AIRFLOW PER UNIT FRONTAL AREA	107.32	118.12	128.68	135.63	137.53
AIRFLOW PER UNIT ANNULUS AREA	117.26	129.05	140.59	148.19	150.26
AIRFLOW AT ORIFICE	21.75	23.94	26.08	27.49	27.88
AIRFLOW AT IGV INLET	21.77	23.91	26.02	27.46	27.76
AIRFLOW AT ROTOR INLET	21.77	23.95	26.10	27.55	27.87
AIRFLOW AT ROTOR OUTLET	21.45	23.62	25.50	27.44	27.86
AIRFLOW AT STATOR OUTLET	21.28	23.16	24.90	26.38	27.11
ROTATIVE SPEED	9811.3	9834.3	9800.5	9820.5	9792.0
PERCENT OF DESIGN SPEED	90.1	90.3	90.0	90.2	90.0
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.321	1.321	1.295	1.248	1.188
STAGE TOTAL TEMPERATURE RATIO	1.099	1.096	1.091	1.087	1.082
STAGE ADIABATIC EFFICIENCY	0.833	0.860	0.843	0.748	0.614

(e) 80 Percent of design speed

READING NUMBER	0542	0541	0540	0539	0538
IGV TOTAL PRESSURE RATIO	0.998	0.998	0.997	0.996	0.996
ROTOR TOTAL PRESSURE RATIO	1.254	1.253	1.244	1.233	1.216
STATOR TOTAL PRESSURE RATIO	0.991	0.989	0.983	0.970	0.951
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	0.999	1.000	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.079	1.076	1.073	1.069	1.066
STATOR TOTAL TEMPERATURE RATIO	0.999	0.998	0.997	0.998	0.998
ROTOR ADIABATIC EFFICIENCY	0.848	0.878	0.887	0.891	0.871
ROTOR MOMENTUM-RISE EFFICIENCY	0.872	0.915	0.941	0.938	0.934
ROTOR HEAD-RISE COEFFICIENT	0.391	0.387	0.374	0.354	0.331
FLOW COEFFICIENT	0.370	0.419	0.466	0.507	0.537
AIRFLOW PER UNIT FRONTAL AREA	91.87	103.33	113.74	123.17	129.18
AIRFLOW PER UNIT ANNULUS AREA	100.37	112.89	124.26	134.57	141.13
AIRFLOW AT ORIFICE	18.62	20.94	23.05	24.97	26.18
AIRFLOW AT IGV INLET	18.65	20.94	23.06	24.92	26.14
AIRFLOW AT ROTOR INLET	18.65	20.96	23.08	24.93	26.19
AIRFLOW AT ROTOR OUTLET	18.28	20.66	22.76	24.73	26.13
AIRFLOW AT STATOR OUTLET	18.21	20.10	21.91	23.79	25.24
ROTATIVE SPEED	8687.5	8707.8	8703.0	8719.2	8698.7
PERCENT OF DESIGN SPEED	79.8	80.0	79.9	80.1	79.9
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.241	1.237	1.219	1.190	1.151
STAGE TOTAL TEMPERATURE RATIO	1.077	1.073	1.069	1.066	1.063
STAGE ADIABATIC EFFICIENCY	0.821	0.853	0.841	0.769	0.647

(f) 70 Percent of design speed

READING NUMBER	0537	0536	0535	0534	0533
IGV TOTAL PRESSURE RATIO	0.999	0.998	0.998	0.997	0.997
ROTOR TOTAL PRESSURE RATIO	1.191	1.189	1.180	1.171	1.161
STATOR TOTAL PRESSURE RATIO	0.993	0.991	0.985	0.975	0.960
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.061	1.058	1.054	1.052	1.049
STATOR TOTAL TEMPERATURE RATIO	0.999	0.998	0.999	0.999	0.999
ROTOR ADIABATIC EFFICIENCY	0.844	0.870	0.889	0.894	0.887
ROTOR MOMENTUM-RISE EFFICIENCY	0.864	0.913	0.946	0.951	0.960
ROTOR HEAD-RISE COEFFICIENT	0.382	0.377	0.358	0.341	0.321
FLOW COEFFICIENT	0.359	0.413	0.471	0.509	0.545
AIRFLOW PER UNIT FRONTAL AREA	78.87	90.12	101.84	109.80	116.77
AIRFLOW PER UNIT ANNULUS AREA	86.17	98.46	111.27	119.96	127.57
AIRFLOW AT ORIFICE	15.99	18.27	20.64	22.25	23.67
AIRFLOW AT IGV INLET	16.00	18.29	20.66	22.22	23.60
AIRFLOW AT ROTOR INLET	15.99	18.27	20.65	22.25	23.63
AIRFLOW AT ROTOR OUTLET	15.65	17.99	20.39	22.05	23.52
AIRFLOW AT STATOR OUTLET	15.66	17.50	19.69	21.25	22.64
ROTATIVE SPEED	7620.5	7629.3	7631.8	7636.2	7630.4
PERCENT OF DESIGN SPEED	70.0	70.1	70.1	70.1	70.1
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.181	1.176	1.159	1.139	1.111
STAGE TOTAL TEMPERATURE RATIO	1.060	1.056	1.052	1.050	1.048
STAGE ADIABATIC EFFICIENCY	0.817	0.845	0.828	0.760	0.639

TABLE III. - Concluded. OVERALL PERFORMANCE OF STAGE 57M2C

(g) 60 Percent of design speed

READING NUMBER	0530	0529	0528	0527
IGV TOTAL PRESSURE RATIO	0.999	0.999	0.998	0.998
ROTOR TOTAL PRESSURE RATIO	1.138	1.133	1.124	1.113
STATOR TOTAL PRESSURE RATIO	0.995	0.993	0.984	0.970
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.044	1.041	1.038	1.035
STATOR TOTAL TEMPERATURE RATIO	1.000	0.999	0.999	0.999
ROTOR ADIABATIC EFFICIENCY	0.857	0.883	0.898	0.892
ROTOR MOMENTUM-RISE EFFICIENCY	0.889	0.951	0.973	0.985
ROTOR HEAD-RISE COEFFICIENT	0.374	0.358	0.335	0.307
FLOW COEFFICIENT	0.356	0.433	0.496	0.551
AIRFLOW PER UNIT FRONTAL AREA	67.76	81.69	93.20	102.84
AIRFLOW PER UNIT ANNULUS AREA	74.03	89.25	101.83	112.36
AIRFLOW AT ORIFICE	13.73	16.56	18.89	20.84
AIRFLOW AT IGV INLET	13.75	16.58	18.86	20.79
AIRFLOW AT ROTOR INLET	13.84	16.64	18.91	20.87
AIRFLOW AT ROTOR OUTLET	13.51	16.27	18.78	20.69
AIRFLOW AT STATOR OUTLET	13.43	15.86	18.08	19.98
ROTATIVE SPEED	6559.6	6561.0	6562.0	6560.9
PERCENT OF DESIGN SPEED	60.3	60.3	60.3	60.3
COMPRESSOR PERFORMANCE				
STAGE TOTAL PRESSURE RATIO	1.131	1.123	1.104	1.077
STAGE TOTAL TEMPERATURE RATIO	1.044	1.040	1.036	1.034
STAGE ADIABATIC EFFICIENCY	0.822	0.854	0.794	0.639

TABLE IV. - OVERALL PERFORMANCE OF STAGE 37M2D

(a) 120 Percent of design speed

READING NUMBER	0578	0577	0576	0575	0574
IGV TOTAL PRESSURE RATIO	0.981	0.974	0.973	0.971	0.971
ROTOR TOTAL PRESSURE RATIO	1.646	1.597	1.541	1.459	1.401
STATOR TOTAL PRESSURE RATIO	0.965	0.958	0.945	0.949	0.933
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.207	1.197	1.184	1.168	1.159
STATOR TOTAL TEMPERATURE RATIO	0.993	0.996	0.997	1.003	1.004
ROTOR ADIABATIC EFFICIENCY	0.739	0.727	0.715	0.676	0.636
ROTOR MOMENTUM-RISE EFFICIENCY	0.743	0.726	0.697	0.648	0.619
ROTOR HEAD-RISE COEFFICIENT	0.443	0.409	0.372	0.316	0.281
FLOW COEFFICIENT	0.395	0.415	0.418	0.417	0.419
AIRFLOW PER UNIT FRONTAL AREA	140.15	145.82	147.19	147.04	147.23
AIRFLOW PER UNIT ANNULUS AREA	153.12	159.31	160.81	160.65	160.86
AIRFLOW AT ORIFICE	28.41	29.56	29.83	29.80	29.84
AIRFLOW AT IGV INLET	28.44	29.61	29.81	29.83	29.83
AIRFLOW AT ROTOR INLET	28.75	29.81	29.95	29.90	29.93
AIRFLOW AT ROTOR OUTLET	29.14	30.01	31.09	30.53	30.32
AIRFLOW AT STATOR OUTLET	28.71	28.50	28.42	28.71	29.99
ROTATIVE SPEED	13065.5	13077.5	13084.0	13117.3	13061.9
PERCENT OF DESIGN SPEED	120.0	120.1	120.2	120.5	120.0
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.557	1.491	1.417	1.344	1.270
STAGE TOTAL TEMPERATURE RATIO	1.198	1.191	1.179	1.171	1.162
STAGE ADIABATIC EFFICIENCY	0.682	0.634	0.585	0.515	0.435

(b) 110 Percent of design speed

READING NUMBER	0573	0572	0571	0570	0569
IGV TOTAL PRESSURE RATIO	0.985	0.979	0.977	0.976	0.976
ROTOR TOTAL PRESSURE RATIO	1.558	1.530	1.485	1.428	1.364
STATOR TOTAL PRESSURE RATIO	0.983	0.970	0.959	0.950	0.944
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.173	1.165	1.158	1.149	1.139
STATOR TOTAL TEMPERATURE RATIO	0.996	0.998	0.997	0.999	1.001
ROTOR ADIABATIC EFFICIENCY	0.783	0.784	0.758	0.720	0.669
ROTOR MOMENTUM-RISE EFFICIENCY	0.788	0.769	0.750	0.707	0.659
ROTOR HEAD-RISE COEFFICIENT	0.453	0.430	0.395	0.351	0.301
FLOW COEFFICIENT	0.414	0.437	0.446	0.448	0.448
AIRFLOW PER UNIT FRONTAL AREA	135.46	141.56	144.18	144.73	145.08
AIRFLOW PER UNIT ANNULUS AREA	147.99	154.66	157.52	158.12	158.51
AIRFLOW AT ORIFICE	27.45	28.69	29.22	29.33	29.41
AIRFLOW AT IGV INLET	27.46	28.71	29.20	29.33	29.37
AIRFLOW AT ROTOR INLET	27.80	29.02	29.46	29.54	29.59
AIRFLOW AT ROTOR OUTLET	26.78	29.04	29.73	30.04	29.70
AIRFLOW AT STATOR OUTLET	27.33	27.49	27.69	28.08	29.18
ROTATIVE SPEED	11963.5	11961.7	11969.9	11979.3	11983.9
PERCENT OF DESIGN SPEED	109.9	109.9	110.0	110.0	110.1
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.508	1.452	1.392	1.324	1.256
STAGE TOTAL TEMPERATURE RATIO	1.167	1.161	1.154	1.146	1.139
STAGE ADIABATIC EFFICIENCY	0.744	0.697	0.644	0.573	0.486

(c) 100 Percent of design speed

READING NUMBER	0568	0566	0565	0564	0563
IGV TOTAL PRESSURE RATIO	0.989	0.985	0.981	0.979	0.979
ROTOR TOTAL PRESSURE RATIO	1.477	1.464	1.429	1.374	1.329
STATOR TOTAL PRESSURE RATIO	0.987	0.981	0.968	0.957	0.947
IGV TOTAL TEMPERATURE RATIO	1.000	0.999	0.999	0.998	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.142	1.136	1.133	1.130	1.119
STATOR TOTAL TEMPERATURE RATIO	0.997	1.000	0.998	0.994	0.999
ROTOR ADIABATIC EFFICIENCY	0.829	0.847	0.806	0.733	0.709
ROTOR MOMENTUM-RISE EFFICIENCY	0.832	0.837	0.799	0.757	0.726
ROTOR HEAD-RISE COEFFICIENT	0.466	0.455	0.418	0.368	0.326
FLOW COEFFICIENT	0.416	0.453	0.470	0.478	0.479
AIRFLOW PER UNIT FRONTAL AREA	125.09	134.22	139.39	141.66	141.94
AIRFLOW PER UNIT ANNULUS AREA	136.66	146.64	152.29	154.77	155.08
AIRFLOW AT ORIFICE	25.35	27.20	28.25	28.71	28.77
AIRFLOW AT IGV INLET	25.38	27.25	28.28	28.65	28.72
AIRFLOW AT ROTOR INLET	25.59	27.59	28.56	28.89	28.96
AIRFLOW AT ROTOR OUTLET	25.11	26.75	28.62	28.74	28.82
AIRFLOW AT STATOR OUTLET	25.02	26.17	26.92	27.31	28.12
ROTATIVE SPEED	10870.5	10848.3	10910.5	10908.6	10901.5
PERCENT OF DESIGN SPEED	99.9	99.7	100.2	100.2	100.1
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.440	1.414	1.356	1.287	1.232
STAGE TOTAL TEMPERATURE RATIO	1.138	1.135	1.130	1.121	1.117
STAGE ADIABATIC EFFICIENCY	0.796	0.772	0.699	0.619	0.525

TABLE IV. - Concluded. OVERALL PERFORMANCE OF STAGE 57M2D

(d) 90 Percent of design speed

READING NUMBER	0579
IGV TOTAL PRESSURE RATIO	0.992
ROTOR TOTAL PRESSURE RATIO	1.356
STATOR TOTAL PRESSURE RATIO	0.991
IGV TOTAL TEMPERATURE RATIO	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.108
STATOR TOTAL TEMPERATURE RATIO	1.000
ROTOR ADIABATIC EFFICIENCY	0.839
ROTOR MOMENTUM-RISE EFFICIENCY	0.836
ROTOR HEAD-RISE COEFFICIENT	0.430
FLOW COEFFICIENT	0.403
AIRFLOW PER UNIT FRONTAL AREA	110.94
AIRFLOW PER UNIT ANNULUS AREA	121.21
AIRFLOW AT ORIFICE	22.49
AIRFLOW AT IGV INLET	22.50
AIRFLOW AT ROTOR INLET	22.55
AIRFLOW AT ROTOR OUTLET	22.35
AIRFLOW AT STATOR OUTLET	21.85
ROTATIVE SPEED	9787.8
PERCENT OF DESIGN SPEED	89.9
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.332
STAGE TOTAL TEMPERATURE RATIO	1.108
STAGE ADIABATIC EFFICIENCY	0.793

(e) 80 Percent of design speed

READING NUMBER	0580
IGV TOTAL PRESSURE RATIO	0.994
ROTOR TOTAL PRESSURE RATIO	1.274
STATOR TOTAL PRESSURE RATIO	0.987
IGV TOTAL TEMPERATURE RATIO	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.086
STATOR TOTAL TEMPERATURE RATIO	0.999
ROTOR ADIABATIC EFFICIENCY	0.834
ROTOR MOMENTUM-RISE EFFICIENCY	0.844
ROTOR HEAD-RISE COEFFICIENT	0.418
FLOW COEFFICIENT	0.389
AIRFLOW PER UNIT FRONTAL AREA	96.56
AIRFLOW PER UNIT ANNULUS AREA	105.59
AIRFLOW AT ORIFICE	19.57
AIRFLOW AT IGV INLET	19.59
AIRFLOW AT ROTOR INLET	19.61
AIRFLOW AT ROTOR OUTLET	19.53
AIRFLOW AT STATOR OUTLET	18.83
ROTATIVE SPEED	8721.2
PERCENT OF DESIGN SPEED	80.1
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.249
STAGE TOTAL TEMPERATURE RATIO	1.084
STAGE ADIABATIC EFFICIENCY	0.784

(f) 70 Percent of design speed

READING NUMBER	0587	0586	0585	0584	0583
IGV TOTAL PRESSURE RATIO	0.996	0.995	0.993	0.992	0.990
ROTOR TOTAL PRESSURE RATIO	1.205	1.205	1.195	1.188	1.184
STATOR TOTAL PRESSURE RATIO	0.989	0.985	0.978	0.970	0.960
IGV TOTAL TEMPERATURE RATIO	1.000	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.065	1.062	1.059	1.057	1.056
STATOR TOTAL TEMPERATURE RATIO	0.998	0.998	0.999	1.000	1.000
ROTOR ADIABATIC EFFICIENCY	0.841	0.878	0.889	0.884	0.875
ROTOR MOMENTUM-RISE EFFICIENCY	0.658	0.908	0.921	0.921	0.925
ROTOR HEAD-RISE COEFFICIENT	0.407	0.405	0.386	0.373	0.365
FLOW COEFFICIENT	0.393	0.445	0.502	0.532	0.556
AIRFLOW PER UNIT FRONTAL AREA	86.36	97.68	108.58	114.48	118.93
AIRFLOW PER UNIT ANNULUS AREA	94.35	106.72	118.63	125.07	129.93
AIRFLOW AT ORIFICE	17.50	19.80	22.01	23.20	24.10
AIRFLOW AT IGV INLET	17.54	19.71	22.02	23.18	24.08
AIRFLOW AT ROTOR INLET	17.48	19.83	22.04	23.22	24.08
AIRFLOW AT ROTOR OUTLET	17.59	19.87	21.66	22.77	23.67
AIRFLOW AT STATOR OUTLET	16.75	18.74	20.79	21.99	23.10
ROTATIVE SPEED	7666.3	7665.9	7663.3	7656.6	7646.7
PERCENT OF DESIGN SPEED	70.4	70.4	70.4	70.3	70.2
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.187	1.180	1.161	1.143	1.125
STAGE TOTAL TEMPERATURE RATIO	1.063	1.060	1.057	1.056	1.056
STAGE ADIABATIC EFFICIENCY	0.805	0.812	0.758	0.689	0.610

(g) 60 Percent of design speed

READING NUMBER	0588
IGV TOTAL PRESSURE RATIO	0.997
ROTOR TOTAL PRESSURE RATIO	1.147
STATOR TOTAL PRESSURE RATIO	0.992
IGV TOTAL TEMPERATURE RATIO	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.048
STATOR TOTAL TEMPERATURE RATIO	0.998
ROTOR ADIABATIC EFFICIENCY	0.835
ROTOR MOMENTUM-RISE EFFICIENCY	0.854
ROTOR HEAD-RISE COEFFICIENT	0.397
FLOW COEFFICIENT	0.381
AIRFLOW PER UNIT FRONTAL AREA	72.08
AIRFLOW PER UNIT ANNULUS AREA	78.75
AIRFLOW AT ORIFICE	14.61
AIRFLOW AT IGV INLET	14.68
AIRFLOW AT ROTOR INLET	14.65
AIRFLOW AT ROTOR OUTLET	14.63
AIRFLOW AT STATOR OUTLET	14.02
ROTATIVE SPEED	6560.3
PERCENT OF DESIGN SPEED	60.3
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.134
STAGE TOTAL TEMPERATURE RATIO	1.046
STAGE ADIABATIC EFFICIENCY	0.803

TABLE V. - OVERALL PERFORMANCE OF STAGE 57M2E

(a) 120 Percent of design speed

READING NUMBER	0606	0605	0604	0603	0602
IGV TOTAL PRESSURE RATIO	0.994	0.993	0.993	0.993	0.993
ROTOR TOTAL PRESSURE RATIO	1.554	1.461	1.391	1.335	1.270
STATOR TOTAL PRESSURE RATIO	0.969	0.994	1.004	0.994	0.969
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.153	1.139	1.128	1.120	1.105
STATOR TOTAL TEMPERATURE RATIO	0.993	0.992	0.992	0.990	0.989
ROTOR ADIABATIC EFFICIENCY	0.879	0.824	0.776	0.718	0.672
ROTOR MOMENTUM-RISE EFFICIENCY	0.930	0.908	0.871	0.812	0.744
ROTOR HEAD-RISE COEFFICIENT	0.370	0.311	0.266	0.230	0.186
FLOW COEFFICIENT	0.347	0.374	0.383	0.385	0.385
AIRFLOW PER UNIT FRONTAL AREA	126.00	134.31	136.94	137.76	138.08
AIRFLOW PER UNIT ANNULUS AREA	137.66	146.74	149.62	150.51	150.86
AIRFLOW AT ORIFICE	25.54	27.22	27.76	27.92	27.99
AIRFLOW AT IGV INLET	25.52	27.20	27.77	27.87	27.95
AIRFLOW AT ROTOR INLET	25.13	26.80	27.39	27.51	27.57
AIRFLOW AT ROTOR OUTLET	24.65	25.85	26.45	27.10	28.03
AIRFLOW AT STATOR OUTLET	25.64	27.22	27.91	27.61	27.40
ROTATIVE SPEED	13082.1	13084.2	13106.6	13100.8	13116.9
PERCENT OF DESIGN SPEED	120.2	120.2	120.4	120.3	120.5
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.497	1.444	1.387	1.318	1.223
STAGE TOTAL TEMPERATURE RATIO	1.143	1.128	1.118	1.107	1.093
STAGE ADIABATIC EFFICIENCY	0.854	0.864	0.831	0.764	0.640

(b) 110 Percent of design speed

READING NUMBER	0601	0600	0596	0597	0599
IGV TOTAL PRESSURE RATIO	0.996	0.995	0.994	0.994	0.994
ROTOR TOTAL PRESSURE RATIO	1.446	1.390	1.355	1.299	1.234
STATOR TOTAL PRESSURE RATIO	0.975	0.991	0.991	0.990	0.973
IGV TOTAL TEMPERATURE RATIO	1.000	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.126	1.114	1.107	1.100	1.087
STATOR TOTAL TEMPERATURE RATIO	0.994	0.993	0.992	0.990	0.990
ROTOR ADIABATIC EFFICIENCY	0.884	0.865	0.848	0.774	0.709
ROTOR MOMENTUM-RISE EFFICIENCY	0.943	0.949	0.935	0.877	0.805
ROTOR HEAD-RISE COEFFICIENT	0.358	0.314	0.288	0.245	0.193
FLOW COEFFICIENT	0.338	0.373	0.392	0.405	0.407
AIRFLOW PER UNIT FRONTAL AREA	113.55	123.99	129.34	132.94	133.72
AIRFLOW PER UNIT ANNULUS AREA	124.06	135.47	141.31	145.25	146.10
AIRFLOW AT ORIFICE	23.02	25.13	26.22	26.95	27.10
AIRFLOW AT IGV INLET	22.99	25.08	26.20	26.92	27.06
AIRFLOW AT ROTOR INLET	22.61	24.73	25.78	26.51	26.65
AIRFLOW AT ROTOR OUTLET	22.31	24.13	25.49	26.41	26.85
AIRFLOW AT STATOR OUTLET	23.01	24.87	25.84	26.53	26.43
ROTATIVE SPEED	11963.2	11959.5	11950.2	11949.4	11943.3
PERCENT OF DESIGN SPEED	109.9	109.9	109.8	109.8	109.7
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.404	1.370	1.335	1.278	1.193
STAGE TOTAL TEMPERATURE RATIO	1.119	1.105	1.098	1.089	1.076
STAGE ADIABATIC EFFICIENCY	0.859	0.897	0.881	0.820	0.685

(c) 100 Percent of design speed

READING NUMBER	0595	0594	0593	0592	0591
IGV TOTAL PRESSURE RATIO	0.997	0.996	0.995	0.994	0.994
ROTOR TOTAL PRESSURE RATIO	1.358	1.328	1.288	1.255	1.204
STATOR TOTAL PRESSURE RATIO	0.977	0.987	0.990	0.982	0.974
IGV TOTAL TEMPERATURE RATIO	1.000	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.104	1.097	1.086	1.081	1.073
STATOR TOTAL TEMPERATURE RATIO	0.995	0.993	0.995	0.990	0.990
ROTOR ADIABATIC EFFICIENCY	0.883	0.871	0.869	0.823	0.746
ROTOR MOMENTUM-RISE EFFICIENCY	0.938	0.950	0.953	0.933	0.858
ROTOR HEAD-RISE COEFFICIENT	0.350	0.321	0.282	0.251	0.202
FLOW COEFFICIENT	0.330	0.359	0.391	0.419	0.428
AIRFLOW PER UNIT FRONTAL AREA	101.78	109.94	118.59	126.34	128.76
AIRFLOW PER UNIT ANNULUS AREA	111.20	120.12	129.57	138.04	140.67
AIRFLOW AT ORIFICE	20.63	22.28	24.04	25.61	26.10
AIRFLOW AT IGV INLET	20.64	22.28	24.05	25.58	26.04
AIRFLOW AT ROTOR INLET	20.25	21.85	23.63	25.16	25.64
AIRFLOW AT ROTOR OUTLET	20.13	21.53	23.41	25.39	25.71
AIRFLOW AT STATOR OUTLET	20.59	21.97	23.34	25.02	25.33
ROTATIVE SPEED	10865.3	10870.4	10863.2	10870.9	0869.7
PERCENT OF DESIGN SPEED	99.8	99.9	99.8	99.9	99.9
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.323	1.305	1.268	1.226	1.166
STAGE TOTAL TEMPERATURE RATIO	1.097	1.089	1.080	1.070	1.061
STAGE ADIABATIC EFFICIENCY	0.856	0.888	0.884	0.856	0.736

TABLE V. - Concluded. OVERALL PERFORMANCE OF STAGE 57M2E

(d) 90 Percent of design speed

READING NUMBER	0607
IGV TOTAL PRESSURE RATIO	0.997
ROTOR TOTAL PRESSURE RATIO	1.282
STATOR TOTAL PRESSURE RATIO	0.982
IGV TOTAL TEMPERATURE RATIO	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.084
STATOR TOTAL TEMPERATURE RATIO	0.996
ROTOR ADIABATIC EFFICIENCY	0.878
ROTOR MOMENTUM-RISE EFFICIENCY	0.934
ROTOR HEAD-RISE COEFFICIENT	0.342
FLOW COEFFICIENT	0.324
AIRFLOW PER UNIT FRONTAL AREA	90.62
AIRFLOW PER UNIT ANNULUS AREA	99.00
AIRFLOW AT ORIFICE	18.37
AIRFLOW AT IGV INLET	18.38
AIRFLOW AT ROTOR INLET	18.03
AIRFLOW AT ROTOR OUTLET	17.97
AIRFLOW AT STATOR OUTLET	18.31
ROTATIVE SPEED	9763.0
PERCENT OF DESIGN SPEED	89.7
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.255
STAGE TOTAL TEMPERATURE RATIO	1.078
STAGE ADIABATIC EFFICIENCY	0.856

(e) 80 Percent of design speed

READING NUMBER	0608
IGV TOTAL PRESSURE RATIO	0.998
ROTOR TOTAL PRESSURE RATIO	1.211
STATOR TOTAL PRESSURE RATIO	0.988
IGV TOTAL TEMPERATURE RATIO	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.064
STATOR TOTAL TEMPERATURE RATIO	0.997
ROTOR ADIABATIC EFFICIENCY	0.877
ROTOR MOMENTUM-RISE EFFICIENCY	0.934
ROTOR HEAD-RISE COEFFICIENT	0.328
FLOW COEFFICIENT	0.325
AIRFLOW PER UNIT FRONTAL AREA	80.68
AIRFLOW PER UNIT ANNULUS AREA	88.14
AIRFLOW AT ORIFICE	16.35
AIRFLOW AT IGV INLET	16.38
AIRFLOW AT ROTOR INLET	16.05
AIRFLOW AT ROTOR OUTLET	15.89
AIRFLOW AT STATOR OUTLET	16.19
ROTATIVE SPEED	8631.0
PERCENT OF DESIGN SPEED	79.3
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.194
STAGE TOTAL TEMPERATURE RATIO	1.060
STAGE ADIABATIC EFFICIENCY	0.862

(f) 70 Percent of design speed

READING NUMBER	0614	0613	0612	0611	0609
IGV TOTAL PRESSURE RATIO	0.998	0.998	0.998	0.997	0.997
ROTOR TOTAL PRESSURE RATIO	1.162	1.150	1.135	1.118	1.095
STATOR TOTAL PRESSURE RATIO	0.991	0.994	0.994	0.993	0.986
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	1.000	1.000	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.050	1.046	1.042	1.037	1.032
STATOR TOTAL TEMPERATURE RATIO	0.998	0.998	0.997	0.997	0.996
ROTOR ADIABATIC EFFICIENCY	0.882	0.891	0.881	0.867	0.828
ROTOR MOMENTUM-RISE EFFICIENCY	0.931	0.952	0.966	0.966	0.935
ROTOR HEAD-RISE COEFFICIENT	0.322	0.299	0.269	0.236	0.191
FLOW COEFFICIENT	0.320	0.349	0.385	0.418	0.462
AIRFLOW PER UNIT FRONTAL AREA	70.84	76.71	84.26	91.14	100.15
AIRFLOW PER UNIT ANNULUS AREA	77.39	83.81	92.06	99.57	109.41
AIRFLOW AT ORIFICE	14.36	15.55	17.08	18.47	20.30
AIRFLOW AT IGV INLET	14.38	15.60	17.11	18.53	20.29
AIRFLOW AT ROTOR INLET	14.10	15.29	16.79	18.16	19.90
AIRFLOW AT ROTOR OUTLET	13.92	15.03	16.71	18.10	19.80
AIRFLOW AT STATOR OUTLET	14.19	15.21	16.52	17.86	19.39
ROTATIVE SPEED	7637.8	7629.5	7632.7	7631.4	7620.1
PERCENT OF DESIGN SPEED	70.2	70.1	70.1	70.1	70.0
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.149	1.141	1.125	1.107	1.076
STAGE TOTAL TEMPERATURE RATIO	1.047	1.043	1.038	1.033	1.027
STAGE ADIABATIC EFFICIENCY	0.859	0.890	0.896	0.881	0.770

(g) 60 Percent of design speed

READING NUMBER	0615
IGV TOTAL PRESSURE RATIO	0.999
ROTOR TOTAL PRESSURE RATIO	1.113
STATOR TOTAL PRESSURE RATIO	0.995
IGV TOTAL TEMPERATURE RATIO	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.035
STATOR TOTAL TEMPERATURE RATIO	0.998
ROTOR ADIABATIC EFFICIENCY	0.880
ROTOR MOMENTUM-RISE EFFICIENCY	0.942
ROTOR HEAD-RISE COEFFICIENT	0.307
FLOW COEFFICIENT	0.328
AIRFLOW PER UNIT FRONTAL AREA	62.59
AIRFLOW PER UNIT ANNULUS AREA	68.39
AIRFLOW AT ORIFICE	12.69
AIRFLOW AT IGV INLET	12.72
AIRFLOW AT ROTOR INLET	12.47
AIRFLOW AT ROTOR OUTLET	12.28
AIRFLOW AT STATOR OUTLET	12.46
ROTATIVE SPEED	6558.6
PERCENT OF DESIGN SPEED	60.2
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.106
STAGE TOTAL TEMPERATURE RATIO	1.033
STAGE ADIABATIC EFFICIENCY	0.873

TABLE VI. - OVERALL PERFORMANCE OF STAGE 57M2F

(a) 120 Percent of design speed

READING NUMBER	0635	0634	0633	0632	0631
IGV TOTAL PRESSURE RATIO	0.993	0.991	0.990	0.990	0.990
ROTOR TOTAL PRESSURE RATIO	1.512	1.439	1.324	1.291	1.237
STATOR TOTAL PRESSURE RATIO	0.961	0.984	1.008	1.006	0.974
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.139	1.131	1.112	1.106	1.093
STATOR TOTAL TEMPERATURE RATIO	0.994	0.987	0.992	0.992	0.989
ROTOR ADIABATIC EFFICIENCY	0.901	0.819	0.744	0.715	0.675
ROTOR MOMENTUM-RISE EFFICIENCY	0.949	0.924	0.854	0.833	0.781
ROTOR HEAD-RISE COEFFICIENT	0.343	0.292	0.223	0.201	0.165
FLOW COEFFICIENT	0.331	0.368	0.372	0.373	0.373
AIRFLOW PER UNIT FRONTAL AREA	128.67	129.42	133.18	133.59	133.78
AIRFLOW PER UNIT ANNULUS AREA	131.83	141.48	145.58	145.95	146.08
AIRFLOW AT ORIFICE	24.46	26.23	26.99	27.08	27.10
AIRFLOW AT IGV INLET	24.44	26.22	27.01	27.06	27.04
AIRFLOW AT ROTOR INLET	23.95	25.71	26.51	26.57	26.58
AIRFLOW AT ROTOR OUTLET	23.76	24.78	25.85	25.89	26.95
AIRFLOW AT STATOR OUTLET	24.44	26.20	26.87	26.91	26.53
ROTATIVE SPEED	13049.8	13048.9	13048.2	13041.5	13035.9
PERCENT OF DESIGN SPEED	119.9	119.9	119.9	119.8	119.7
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.442	1.395	1.320	1.287	1.193
STAGE TOTAL TEMPERATURE RATIO	1.131	1.115	1.102	1.096	1.080
STAGE ADIABATIC EFFICIENCY	0.839	0.865	0.813	0.774	0.643

(b) 110 Percent of design speed

READING NUMBER	0630	0629	0628	0627	0626
IGV TOTAL PRESSURE RATIO	0.994	0.993	0.992	0.991	0.991
ROTOR TOTAL PRESSURE RATIO	1.418	1.365	1.309	1.275	1.220
STATOR TOTAL PRESSURE RATIO	0.969	0.985	0.998	0.998	0.972
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.117	1.110	1.096	1.093	1.083
STATOR TOTAL TEMPERATURE RATIO	0.994	0.989	0.994	0.989	0.987
ROTOR ADIABATIC EFFICIENCY	0.894	0.843	0.836	0.777	0.708
ROTOR MOMENTUM-RISE EFFICIENCY	0.962	0.947	0.936	0.913	0.839
ROTOR HEAD-RISE COEFFICIENT	0.334	0.294	0.249	0.223	0.180
FLOW COEFFICIENT	0.326	0.354	0.376	0.389	0.392
AIRFLOW PER UNIT FRONTAL AREA	118.03	118.30	124.93	128.70	129.92
AIRFLOW PER UNIT ANNULUS AREA	120.21	129.24	136.49	140.62	141.94
AIRFLOW AT ORIFICE	22.30	23.98	25.32	26.09	26.33
AIRFLOW AT IGV INLET	22.31	24.01	25.31	26.10	26.27
AIRFLOW AT ROTOR INLET	21.81	23.50	24.81	25.62	25.78
AIRFLOW AT ROTOR OUTLET	21.64	22.94	23.81	25.44	26.14
AIRFLOW AT STATOR OUTLET	22.19	23.82	24.94	25.71	25.69
ROTATIVE SPEED	11985.6	11981.1	11990.0	11990.9	11984.5
PERCENT OF DESIGN SPEED	110.1	110.1	110.1	110.2	110.1
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.365	1.335	1.296	1.251	1.175
STAGE TOTAL TEMPERATURE RATIO	1.110	1.097	1.088	1.079	1.068
STAGE ADIABATIC EFFICIENCY	0.844	0.883	0.873	0.833	0.700

(c) 100 Percent of design speed

READING NUMBER	0625	0624	0621	0620	0619
IGV TOTAL PRESSURE RATIO	0.995	0.994	0.993	0.992	0.993
ROTOR TOTAL PRESSURE RATIO	1.337	1.302	1.253	1.186	1.233
STATOR TOTAL PRESSURE RATIO	0.974	0.984	0.995	0.977	0.986
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.097	1.091	1.079	1.067	1.075
STATOR TOTAL TEMPERATURE RATIO	0.994	0.991	0.994	0.990	0.991
ROTOR ADIABATIC EFFICIENCY	0.888	0.858	0.845	0.753	0.819
ROTOR MOMENTUM-RISE EFFICIENCY	0.951	0.958	0.952	0.882	0.962
ROTOR HEAD-RISE COEFFICIENT	0.328	0.295	0.248	0.184	0.229
FLOW COEFFICIENT	0.321	0.348	0.376	0.412	0.398
AIRFLOW PER UNIT FRONTAL AREA	99.20	106.82	114.91	124.66	120.68
AIRFLOW PER UNIT ANNULUS AREA	108.39	116.71	125.54	136.20	131.84
AIRFLOW AT ORIFICE	20.11	21.65	23.29	25.27	24.46
AIRFLOW AT IGV INLET	20.12	21.65	23.27	25.24	24.47
AIRFLOW AT ROTOR INLET	19.67	21.17	22.80	24.76	23.97
AIRFLOW AT ROTOR OUTLET	19.64	20.90	22.19	24.85	23.88
AIRFLOW AT STATOR OUTLET	19.94	21.39	22.80	24.54	23.83
ROTATIVE SPEED	10869.5	10879.3	10888.3	10888.6	10886.4
PERCENT OF DESIGN SPEED	99.8	99.9	100.0	100.0	100.0
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.295	1.273	1.239	1.149	1.208
STAGE TOTAL TEMPERATURE RATIO	1.090	1.081	1.072	1.054	1.064
STAGE ADIABATIC EFFICIENCY	0.849	0.882	0.883	0.754	0.858

TABLE VI. - Concluded. OVERALL PERFORMANCE OF STAGE 37M2F

(d) 90 Percent of design speed

READING NUMBER	0636
IGV TOTAL PRESSURE RATIO	0.996
ROTOR TOTAL PRESSURE RATIO	1.265
STATOR TOTAL PRESSURE RATIO	0.980
IGV TOTAL TEMPERATURE RATIO	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.078
STATOR TOTAL TEMPERATURE RATIO	0.996
ROTOR ADIABATIC EFFICIENCY	0.889
ROTOR MOMENTUM-RISE EFFICIENCY	0.943
ROTOR HEAD-RISE COEFFICIENT	0.320
FLOW COEFFICIENT	0.316
AIRFLOW PER UNIT FRONTAL AREA	88.37
AIRFLOW PER UNIT ANNULUS AREA	96.55
AIRFLOW AT ORIFICE	17.91
AIRFLOW AT IGV INLET	17.96
AIRFLOW AT ROTOR INLET	17.55
AIRFLOW AT ROTOR OUTLET	17.37
AIRFLOW AT STATOR OUTLET	17.81
ROTATIVE SPEED	9782.6
PERCENT OF DESIGN SPEED	89.9
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.235
STAGE TOTAL TEMPERATURE RATIO	1.074
STAGE ADIABATIC EFFICIENCY	0.845

(e) 80 Percent of design speed

READING NUMBER	0637
IGV TOTAL PRESSURE RATIO	0.997
ROTOR TOTAL PRESSURE RATIO	1.206
STATOR TOTAL PRESSURE RATIO	0.984
IGV TOTAL TEMPERATURE RATIO	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.062
STATOR TOTAL TEMPERATURE RATIO	0.997
ROTOR ADIABATIC EFFICIENCY	0.890
ROTOR MOMENTUM-RISE EFFICIENCY	0.944
ROTOR HEAD-RISE COEFFICIENT	0.315
FLOW COEFFICIENT	0.311
AIRFLOW PER UNIT FRONTAL AREA	78.03
AIRFLOW PER UNIT ANNULUS AREA	85.25
AIRFLOW AT ORIFICE	15.82
AIRFLOW AT IGV INLET	15.86
AIRFLOW AT ROTOR INLET	15.50
AIRFLOW AT ROTOR OUTLET	15.33
AIRFLOW AT STATOR OUTLET	15.70
ROTATIVE SPEED	8713.7
PERCENT OF DESIGN SPEED	80.0
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.184
STAGE TOTAL TEMPERATURE RATIO	1.058
STAGE ADIABATIC EFFICIENCY	0.847

(f) 70 Percent of design speed

READING NUMBER	0643	0641	0640	0639	0638
IGV TOTAL PRESSURE RATIO	0.998	0.997	0.997	0.996	0.995
ROTOR TOTAL PRESSURE RATIO	1.153	1.133	1.116	1.104	1.083
STATOR TOTAL PRESSURE RATIO	0.989	0.995	0.995	0.992	0.987
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	1.000	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.046	1.042	1.036	1.033	1.028
STATOR TOTAL TEMPERATURE RATIO	0.998	0.997	0.998	0.996	0.997
ROTOR ADIABATIC EFFICIENCY	0.896	0.875	0.882	0.867	0.838
ROTOR MOMENTUM-RISE EFFICIENCY	0.948	0.979	1.007	1.018	0.968
ROTOR HEAD-RISE COEFFICIENT	0.306	0.267	0.233	0.209	0.167
FLOW COEFFICIENT	0.388	0.348	0.382	0.413	0.444
AIRFLOW PER UNIT FRONTAL AREA	68.81	76.39	83.54	89.99	96.34
AIRFLOW PER UNIT ANNULUS AREA	75.17	83.45	91.27	98.32	105.26
AIRFLOW AT ORIFICE	13.95	15.48	16.93	18.24	19.53
AIRFLOW AT IGV INLET	13.79	15.53	17.00	18.29	19.55
AIRFLOW AT ROTOR INLET	13.67	15.18	16.62	17.88	19.11
AIRFLOW AT ROTOR OUTLET	13.46	14.48	16.07	17.55	19.02
AIRFLOW AT STATOR OUTLET	13.76	15.11	16.39	17.62	18.78
ROTATIVE SPEED	7631.4	7627.5	7621.5	7631.0	7622.5
PERCENT OF DESIGN SPEED	70.1	70.1	70.0	70.1	70.0
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.138	1.124	1.107	1.091	1.064
STAGE TOTAL TEMPERATURE RATIO	1.044	1.038	1.033	1.029	1.023
STAGE ADIABATIC EFFICIENCY	0.847	0.886	0.890	0.870	0.766

(g) 60 Percent of design speed

READING NUMBER	0644
IGV TOTAL PRESSURE RATIO	0.998
ROTOR TOTAL PRESSURE RATIO	1.107
STATOR TOTAL PRESSURE RATIO	0.993
IGV TOTAL TEMPERATURE RATIO	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.033
STATOR TOTAL TEMPERATURE RATIO	0.998
ROTOR ADIABATIC EFFICIENCY	0.898
ROTOR MOMENTUM-RISE EFFICIENCY	0.955
ROTOR HEAD-RISE COEFFICIENT	0.294
FLOW COEFFICIENT	0.317
AIRFLOW PER UNIT FRONTAL AREA	60.23
AIRFLOW PER UNIT ANNULUS AREA	65.80
AIRFLOW AT ORIFICE	12.21
AIRFLOW AT IGV INLET	12.24
AIRFLOW AT ROTOR INLET	11.99
AIRFLOW AT ROTOR OUTLET	11.78
AIRFLOW AT STATOR OUTLET	11.93
ROTATIVE SPEED	6525.1
PERCENT OF DESIGN SPEED	59.9
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.097
STAGE TOTAL TEMPERATURE RATIO	1.031
STAGE ADIABATIC EFFICIENCY	0.855

TABLE VII. - OVERALL PERFORMANCE OF STAGE 57M2G

(a) 120 Percent of design speed

READING NUMBER	0662	0661	0660	0659	0658
IGV TOTAL PRESSURE RATIO	0.992	0.990	0.989	0.989	0.988
ROTOR TOTAL PRESSURE RATIO	1.466	1.390	1.319	1.259	1.218
STATOR TOTAL PRESSURE RATIO	0.955	0.983	0.991	0.999	0.970
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.133	1.121	1.108	1.098	1.088
STATOR TOTAL TEMPERATURE RATIO	0.990	0.988	0.989	0.989	0.988
ROTOR ADIABATIC EFFICIENCY	0.866	0.815	0.759	0.693	0.663
ROTOR MOMENTUM-RISE EFFICIENCY	0.947	0.909	0.890	0.839	0.781
ROTOR HEAD-RISE COEFFICIENT	0.312	0.264	0.217	0.178	0.151
FLOW COEFFICIENT	0.312	0.333	0.347	0.350	0.350
AIRFLOW PER UNIT FRONTAL AREA	115.01	121.77	126.00	126.82	126.99
AIRFLOW PER UNIT ANNULUS AREA	125.65	133.03	137.66	138.56	138.74
AIRFLOW AT ORIFICE	23.31	24.68	25.54	25.71	25.74
AIRFLOW AT IGV INLET	23.26	24.64	25.53	25.66	25.71
AIRFLOW AT ROTOR INLET	23.20	24.62	25.56	25.72	25.74
AIRFLOW AT ROTOR OUTLET	22.60	23.36	24.81	25.05	25.65
AIRFLOW AT STATOR OUTLET	23.27	24.84	25.54	25.75	25.22
ROTATIVE SPEED	13102.7	13102.7	13099.4	13085.1	13082.7
PERCENT OF DESIGN SPEED	120.4	120.4	120.3	120.2	120.2
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.389	1.353	1.292	1.243	1.168
STAGE TOTAL TEMPERATURE RATIO	1.120	1.107	1.094	1.085	1.073
STAGE ADIABATIC EFFICIENCY	0.818	0.847	0.806	0.754	0.622

(b) 110 Percent of design speed

READING NUMBER	0657	0656	0655	0654	0653
IGV TOTAL PRESSURE RATIO	0.995	0.993	0.992	0.991	0.990
ROTOR TOTAL PRESSURE RATIO	1.372	1.330	1.281	1.242	1.192
STATOR TOTAL PRESSURE RATIO	0.966	0.983	0.994	0.986	0.980
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.110	1.101	1.089	1.084	1.073
STATOR TOTAL TEMPERATURE RATIO	0.991	0.992	0.994	0.988	0.989
ROTOR ADIABATIC EFFICIENCY	0.858	0.840	0.822	0.765	0.700
ROTOR MOMENTUM-RISE EFFICIENCY	0.947	0.930	0.922	0.926	0.841
ROTOR HEAD-RISE COEFFICIENT	0.303	0.269	0.230	0.200	0.159
FLOW COEFFICIENT	0.310	0.327	0.345	0.364	0.369
AIRFLOW PER UNIT FRONTAL AREA	104.73	110.06	115.41	120.80	122.40
AIRFLOW PER UNIT ANNULUS AREA	114.43	120.24	126.09	131.98	133.73
AIRFLOW AT ORIFICE	21.23	22.31	23.39	24.49	24.81
AIRFLOW AT IGV INLET	21.21	22.27	23.41	24.48	24.81
AIRFLOW AT ROTOR INLET	21.08	22.19	23.39	24.48	24.83
AIRFLOW AT ROTOR OUTLET	20.56	21.26	22.20	24.01	24.49
AIRFLOW AT STATOR OUTLET	21.15	22.32	23.29	24.21	24.41
ROTATIVE SPEED	11916.5	11919.8	11933.0	11905.1	11915.9
PERCENT OF DESIGN SPEED	109.5	109.5	109.6	109.4	109.5
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.319	1.299	1.264	1.213	1.156
STAGE TOTAL TEMPERATURE RATIO	1.099	1.091	1.081	1.070	1.060
STAGE ADIABATIC EFFICIENCY	0.830	0.854	0.851	0.816	0.706

(c) 100 Percent of design speed

READING NUMBER	0652	0651	0650	0649	0648
IGV TOTAL PRESSURE RATIO	0.996	0.995	0.994	0.992	0.991
ROTOR TOTAL PRESSURE RATIO	1.310	1.267	1.222	1.196	1.159
STATOR TOTAL PRESSURE RATIO	0.968	0.985	0.992	0.985	0.977
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.998
ROTOR TOTAL TEMPERATURE RATIO	1.092	1.083	1.072	1.067	1.058
STATOR TOTAL TEMPERATURE RATIO	0.993	0.992	0.993	0.990	0.991
ROTOR ADIABATIC EFFICIENCY	0.868	0.839	0.815	0.788	0.744
ROTOR MOMENTUM-RISE EFFICIENCY	0.944	0.929	0.936	0.936	0.890
ROTOR HEAD-RISE COEFFICIENT	0.304	0.263	0.220	0.195	0.158
FLOW COEFFICIENT	0.303	0.327	0.353	0.373	0.386
AIRFLOW PER UNIT FRONTAL AREA	93.96	100.60	107.92	113.58	117.38
AIRFLOW PER UNIT ANNULUS AREA	102.65	109.91	117.91	124.09	128.24
AIRFLOW AT ORIFICE	19.04	20.39	21.87	23.02	23.79
AIRFLOW AT IGV INLET	19.03	20.44	21.89	23.03	23.73
AIRFLOW AT ROTOR INLET	18.91	20.31	21.83	23.00	23.69
AIRFLOW AT ROTOR OUTLET	18.49	19.53	21.00	22.72	23.55
AIRFLOW AT STATOR OUTLET	18.91	20.36	21.59	22.61	23.05
ROTATIVE SPEED	10851.4	10848.2	10841.6	10844.8	10847.7
PERCENT OF DESIGN SPEED	99.7	99.7	99.6	99.6	99.6
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.263	1.242	1.206	1.170	1.123
STAGE TOTAL TEMPERATURE RATIO	1.084	1.074	1.064	1.056	1.046
STAGE ADIABATIC EFFICIENCY	0.819	0.861	0.861	0.825	0.728

TABLE VII. - Continued. OVERALL PERFORMANCE OF STAGE 57M2G

(d) 90 Percent of design speed

READING NUMBER	0667	0666	0665	0664	0663
IGV TOTAL PRESSURE RATIO	0.997	0.996	0.995	0.994	0.993
ROTOR TOTAL PRESSURE RATIO	1.252	1.204	1.179	1.157	1.128
STATOR TOTAL PRESSURE RATIO	0.974	0.993	0.995	0.986	0.981
IGV TOTAL TEMPERATURE RATIO	1.000	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.076	1.064	1.058	1.053	1.045
STATOR TOTAL TEMPERATURE RATIO	0.995	0.996	0.995	0.993	0.993
ROTOR ADIABATIC EFFICIENCY	0.869	0.850	0.834	0.804	0.773
ROTOR MOMENTUM-RISE EFFICIENCY	0.933	0.931	0.946	0.947	0.914
ROTOR HEAD-RISE COEFFICIENT	0.301	0.244	0.215	0.189	0.155
FLOW COEFFICIENT	0.295	0.333	0.354	0.380	0.396
AIRFLOW PER UNIT FRONTAL AREA	83.76	93.34	98.97	105.63	109.80
AIRFLOW PER UNIT ANNULUS AREA	91.51	101.98	108.13	115.41	119.96
AIRFLOW AT ORIFICE	16.98	18.92	20.06	21.41	22.26
AIRFLOW AT IGV INLET	16.97	18.96	20.09	21.42	22.23
AIRFLOW AT ROTOR INLET	16.86	18.86	19.98	21.35	22.17
AIRFLOW AT ROTOR OUTLET	16.36	17.99	19.29	21.20	22.15
AIRFLOW AT STATOR OUTLET	16.89	18.78	19.82	20.89	21.58
ROTATIVE SPEED	9843.6	9841.5	9831.5	9837.7	9831.9
PERCENT OF DESIGN SPEED	90.4	90.4	90.3	90.4	90.3
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.215	1.190	1.167	1.134	1.100
STAGE TOTAL TEMPERATURE RATIO	1.071	1.059	1.052	1.044	1.037
STAGE ADIABATIC EFFICIENCY	0.810	0.869	0.871	0.829	0.715

(e) 80 Percent of design speed

READING NUMBER	0674	0673	0670	0669	0668
IGV TOTAL PRESSURE RATIO	0.997	0.996	0.996	0.995	0.995
ROTOR TOTAL PRESSURE RATIO	1.198	1.153	1.134	1.115	1.096
STATOR TOTAL PRESSURE RATIO	0.978	0.995	0.991	0.988	0.984
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	1.000	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.061	1.049	1.044	1.039	1.033
STATOR TOTAL TEMPERATURE RATIO	0.996	0.997	0.995	0.995	0.995
ROTOR ADIABATIC EFFICIENCY	0.869	0.850	0.824	0.820	0.799
ROTOR MOMENTUM-RISE EFFICIENCY	0.929	0.935	0.959	0.953	0.925
ROTOR HEAD-RISE COEFFICIENT	0.302	0.234	0.206	0.177	0.149
FLOW COEFFICIENT	0.294	0.344	0.366	0.389	0.405
AIRFLOW PER UNIT FRONTAL AREA	74.16	85.87	90.99	96.23	100.14
AIRFLOW PER UNIT ANNULUS AREA	81.02	93.81	99.41	105.14	109.40
AIRFLOW AT ORIFICE	15.03	17.40	18.44	19.51	20.30
AIRFLOW AT IGV INLET	15.07	17.46	18.49	19.55	20.29
AIRFLOW AT ROTOR INLET	14.86	17.26	18.34	19.46	20.21
AIRFLOW AT ROTOR OUTLET	14.50	16.58	18.03	19.34	20.17
AIRFLOW AT STATOR OUTLET	14.83	17.07	17.99	18.91	19.52
ROTATIVE SPEED	8717.3	8715.4	8704.6	8697.9	8704.2
PERCENT OF DESIGN SPEED	80.1	80.1	80.0	79.9	80.0
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.168	1.143	1.119	1.096	1.074
STAGE TOTAL TEMPERATURE RATIO	1.056	1.045	1.038	1.032	1.028
STAGE ADIABATIC EFFICIENCY	0.807	0.862	0.857	0.820	0.739

(f) 70 Percent of design speed

READING NUMBER	0685	0684	0683	0682	0680
IGV TOTAL PRESSURE RATIO	0.998	0.997	0.997	0.996	0.996
ROTOR TOTAL PRESSURE RATIO	1.147	1.119	1.107	1.090	1.076
STATOR TOTAL PRESSURE RATIO	0.985	0.995	0.993	0.991	0.987
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	1.000	1.000	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.046	1.038	1.035	1.029	1.026
STATOR TOTAL TEMPERATURE RATIO	0.997	0.998	0.996	0.997	0.997
ROTOR ADIABATIC EFFICIENCY	0.869	0.861	0.835	0.846	0.820
ROTOR MOMENTUM-RISE EFFICIENCY	0.930	0.936	0.956	0.950	0.926
ROTOR HEAD-RISE COEFFICIENT	0.293	0.238	0.215	0.179	0.152
FLOW COEFFICIENT	0.297	0.339	0.368	0.400	0.421
AIRFLOW PER UNIT FRONTAL AREA	65.97	74.86	80.73	87.48	91.99
AIRFLOW PER UNIT ANNULUS AREA	72.07	81.78	88.20	95.58	100.51
AIRFLOW AT ORIFICE	13.37	15.17	16.36	17.73	18.65
AIRFLOW AT IGV INLET	13.38	15.22	16.42	17.81	18.68
AIRFLOW AT ROTOR INLET	13.26	15.06	16.24	17.62	18.52
AIRFLOW AT ROTOR OUTLET	12.95	14.44	15.96	17.51	18.50
AIRFLOW AT STATOR OUTLET	13.21	14.86	15.82	17.10	17.86
ROTATIVE SPEED	7642.7	7650.9	7635.5	7648.7	7649.5
PERCENT OF DESIGN SPEED	70.2	70.3	70.1	70.3	70.3
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.128	1.112	1.096	1.076	1.058
STAGE TOTAL TEMPERATURE RATIO	1.043	1.036	1.031	1.026	1.022
STAGE ADIABATIC EFFICIENCY	0.821	0.868	0.858	0.820	0.742

TABLE VII. - Concluded. OVERALL PERFORMANCE OF STAGE 57M2G

(g) 60 Percent of design speed

READING NUMBER	0679	0678	0677	0676	0675
IGV TOTAL PRESSURE RATIO	0.999	0.998	0.998	0.997	0.997
ROTOR TOTAL PRESSURE RATIO	1.106	1.087	1.076	1.062	1.049
STATOR TOTAL PRESSURE RATIO	0.989	0.997	0.993	0.992	0.989
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	1.000	1.000	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.033	1.028	1.025	1.020	1.017
STATOR TOTAL TEMPERATURE RATIO	0.998	0.999	0.997	0.998	0.998
ROTOR ADIABATIC EFFICIENCY	0.871	0.861	0.836	0.854	0.808
ROTOR MOMENTUM-RISE EFFICIENCY	0.938	0.941	0.963	0.953	0.920
ROTOR HEAD-RISE COEFFICIENT	0.289	0.237	0.208	0.170	0.136
FLOW COEFFICIENT	0.294	0.334	0.374	0.410	0.435
AIRFLOW PER UNIT FRONTAL AREA	55.88	63.38	70.52	76.90	81.28
AIRFLOW PER UNIT ANNULUS AREA	61.06	69.24	77.04	84.02	88.80
AIRFLOW AT ORIFICE	11.33	12.85	14.29	15.59	16.47
AIRFLOW AT IGV INLET	11.35	12.89	14.35	15.66	16.54
AIRFLOW AT ROTOR INLET	11.28	12.77	14.19	15.47	16.33
AIRFLOW AT ROTOR OUTLET	11.01	12.29	14.04	15.44	16.36
AIRFLOW AT STATOR OUTLET	11.17	12.56	13.74	14.96	15.76
ROTATIVE SPEED	6522.9	6528.8	6518.6	6526.9	6511.9
PERCENT OF DESIGN SPEED	59.9	60.0	59.9	60.0	59.8
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.092	1.081	1.066	1.051	1.034
STAGE TOTAL TEMPERATURE RATIO	1.031	1.026	1.022	1.018	1.014
STAGE ADIABATIC EFFICIENCY	0.813	0.856	0.843	0.788	0.669

TABLE VIII. - OVERALL PERFORMANCE OF STAGE 57M2H

(a) 120 Percent of design speed

READING NUMBER	0704	0703	0702	0701	0700
IGV TOTAL PRESSURE RATIO	0.981	0.978	0.975	0.974	0.974
ROTOR TOTAL PRESSURE RATIO	1.437	1.401	1.333	1.250	1.188
STATOR TOTAL PRESSURE RATIO	0.952	0.957	0.974	0.994	1.000
IGV TOTAL TEMPERATURE RATIO	0.998	0.998	0.998	0.998	0.998
ROTOR TOTAL TEMPERATURE RATIO	1.122	1.117	1.106	1.094	1.085
STATOR TOTAL TEMPERATURE RATIO	0.997	0.989	0.988	0.989	0.989
ROTOR ADIABATIC EFFICIENCY	0.896	0.864	0.804	0.700	0.593
ROTOR MOMENTUM-RISE EFFICIENCY	0.980	0.994	0.957	0.879	0.819
ROTOR HEAD-RISE COEFFICIENT	0.292	0.270	0.226	0.172	0.131
FLOW COEFFICIENT	0.297	0.314	0.327	0.334	0.335
AIRFLOW PER UNIT FRONTAL AREA	109.84	115.02	119.41	121.67	122.11
AIRFLOW PER UNIT ANNULUS AREA	120.00	125.66	130.46	132.93	133.42
AIRFLOW AT ORIFICE	22.26	23.31	24.20	24.66	24.75
AIRFLOW AT IGV INLET	22.23	23.31	24.20	24.64	24.72
AIRFLOW AT ROTOR INLET	21.78	22.87	23.72	24.24	24.32
AIRFLOW AT ROTOR OUTLET	21.74	23.07	23.53	23.20	23.09
AIRFLOW AT STATOR OUTLET	22.40	23.41	24.31	24.55	24.52
ROTATIVE SPEED	13089.9	13079.1	13084.5	13086.9	13078.4
PERCENT OF DESIGN SPEED	120.2	120.1	120.2	120.2	120.1
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.343	1.311	1.266	1.210	1.157
STAGE TOTAL TEMPERATURE RATIO	1.116	1.103	1.091	1.080	1.071
STAGE ADIABATIC EFFICIENCY	0.755	0.781	0.765	0.701	0.600

(b) 110 Percent of design speed

READING NUMBER	0699	0698	0697	0696	0695
IGV TOTAL PRESSURE RATIO	0.985	0.983	0.981	0.977	0.976
ROTOR TOTAL PRESSURE RATIO	1.360	1.335	1.291	1.204	1.163
STATOR TOTAL PRESSURE RATIO	0.960	0.965	0.975	0.995	0.998
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.998	0.998	0.998
ROTOR TOTAL TEMPERATURE RATIO	1.103	1.099	1.091	1.076	1.070
STATOR TOTAL TEMPERATURE RATIO	0.996	0.992	0.990	0.990	0.990
ROTOR ADIABATIC EFFICIENCY	0.891	0.873	0.829	0.711	0.628
ROTOR MOMENTUM-RISE EFFICIENCY	0.972	0.994	0.971	0.918	0.865
ROTOR HEAD-RISE COEFFICIENT	0.288	0.269	0.235	0.167	0.134
FLOW COEFFICIENT	0.295	0.310	0.327	0.347	0.352
AIRFLOW PER UNIT FRONTAL AREA	100.60	105.38	110.44	116.43	118.01
AIRFLOW PER UNIT ANNULUS AREA	109.91	115.13	120.66	127.20	128.93
AIRFLOW AT ORIFICE	20.39	21.36	22.39	23.60	23.92
AIRFLOW AT IGV INLET	20.39	21.35	22.40	23.61	23.92
AIRFLOW AT ROTOR INLET	19.91	20.92	21.85	23.07	23.36
AIRFLOW AT ROTOR OUTLET	19.82	21.06	21.91	22.13	22.39
AIRFLOW AT STATOR OUTLET	20.45	21.28	22.35	23.22	23.56
ROTATIVE SPEED	11988.7	11992.0	11983.5	11982.8	11984.1
PERCENT OF DESIGN SPEED	110.1	110.2	110.1	110.1	110.1
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.286	1.266	1.235	1.170	1.134
STAGE TOTAL TEMPERATURE RATIO	1.098	1.089	1.079	1.064	1.057
STAGE ADIABATIC EFFICIENCY	0.762	0.787	0.791	0.717	0.637

(c) 100 Percent of design speed

READING NUMBER	0694	0693	0692	0691	0690
IGV TOTAL PRESSURE RATIO	0.988	0.986	0.984	0.981	0.980
ROTOR TOTAL PRESSURE RATIO	1.293	1.256	1.220	1.169	1.133
STATOR TOTAL PRESSURE RATIO	0.966	0.973	0.982	0.996	0.999
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.998	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.085	1.078	1.072	1.062	1.056
STATOR TOTAL TEMPERATURE RATIO	0.997	0.992	0.991	0.992	0.991
ROTOR ADIABATIC EFFICIENCY	0.894	0.862	0.811	0.733	0.648
ROTOR MOMENTUM-RISE EFFICIENCY	0.978	0.987	0.960	0.923	0.900
ROTOR HEAD-RISE COEFFICIENT	0.285	0.251	0.217	0.167	0.132
FLOW COEFFICIENT	0.293	0.321	0.337	0.353	0.364
AIRFLOW PER UNIT FRONTAL AREA	91.33	99.23	103.60	108.20	111.38
AIRFLOW PER UNIT ANNULUS AREA	99.78	108.41	113.19	118.21	121.69
AIRFLOW AT ORIFICE	18.51	20.11	21.00	21.93	22.57
AIRFLOW AT IGV INLET	18.50	20.15	21.04	21.95	22.59
AIRFLOW AT ROTOR INLET	17.92	19.63	20.56	21.46	22.12
AIRFLOW AT ROTOR OUTLET	18.00	19.99	20.31	20.43	21.07
AIRFLOW AT STATOR OUTLET	18.42	19.98	20.68	21.46	22.13
ROTATIVE SPEED	10877.8	10875.1	10867.0	10869.3	10873.2
PERCENT OF DESIGN SPEED	99.9	99.9	99.8	99.8	99.9
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.235	1.204	1.179	1.143	1.110
STAGE TOTAL TEMPERATURE RATIO	1.081	1.068	1.061	1.052	1.045
STAGE ADIABATIC EFFICIENCY	0.766	0.800	0.791	0.742	0.665

TABLE VIII. - Concluded. OVERALL PERFORMANCE OF STAGE 57M2H

(d) 90 Percent of design speed

READING NUMBER	0705
IGV TOTAL PRESSURE RATIO	0.991
ROTOR TOTAL PRESSURE RATIO	1.229
STATOR TOTAL PRESSURE RATIO	0.973
IGV TOTAL TEMPERATURE RATIO	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.068
STATOR TOTAL TEMPERATURE RATIO	0.998
ROTOR ADIABATIC EFFICIENCY	0.896
ROTOR MOMENTUM-RISE EFFICIENCY	0.974
ROTOR HEAD-RISE COEFFICIENT	0.279
FLOW COEFFICIENT	0.292
AIRFLOW PER UNIT FRONTAL AREA	82.08
AIRFLOW PER UNIT ANNULUS AREA	89.68
AIRFLOW AT ORIFICE	16.64
AIRFLOW AT IGV INLET	16.63
AIRFLOW AT ROTOR INLET	16.17
AIRFLOW AT ROTOR OUTLET	16.16
AIRFLOW AT STATOR OUTLET	16.67
ROTATIVE SPEED	9730.4
PERCENT OF DESIGN SPEED	89.4
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.185
STAGE TOTAL TEMPERATURE RATIO	1.064
STAGE ADIABATIC EFFICIENCY	0.770

(e) 80 Percent of design speed

READING NUMBER	0706
IGV TOTAL PRESSURE RATIO	0.993
ROTOR TOTAL PRESSURE RATIO	1.180
STATOR TOTAL PRESSURE RATIO	0.979
IGV TOTAL TEMPERATURE RATIO	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.054
STATOR TOTAL TEMPERATURE RATIO	0.998
ROTOR ADIABATIC EFFICIENCY	0.895
ROTOR MOMENTUM-RISE EFFICIENCY	0.985
ROTOR HEAD-RISE COEFFICIENT	0.274
FLOW COEFFICIENT	0.294
AIRFLOW PER UNIT FRONTAL AREA	74.07
AIRFLOW PER UNIT ANNULUS AREA	80.93
AIRFLOW AT ORIFICE	15.01
AIRFLOW AT IGV INLET	15.02
AIRFLOW AT ROTOR INLET	14.50
AIRFLOW AT ROTOR OUTLET	14.68
AIRFLOW AT STATOR OUTLET	14.92
ROTATIVE SPEED	8714.1
PERCENT OF DESIGN SPEED	80.0
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.147
STAGE TOTAL TEMPERATURE RATIO	1.051
STAGE ADIABATIC EFFICIENCY	0.783

(f) 70 Percent of design speed

READING NUMBER	0711	0710	0709	0708	0707
IGV TOTAL PRESSURE RATIO	0.995	0.994	0.992	0.991	0.989
ROTOR TOTAL PRESSURE RATIO	1.144	1.125	1.097	1.075	1.060
STATOR TOTAL PRESSURE RATIO	0.981	0.987	0.994	0.997	0.996
IGV TOTAL TEMPERATURE RATIO	1.000	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.044	1.039	1.033	1.028	1.025
STATOR TOTAL TEMPERATURE RATIO	0.999	0.997	0.996	0.996	0.996
ROTOR ADIABATIC EFFICIENCY	0.897	0.885	0.811	0.736	0.680
ROTOR MOMENTUM-RISE EFFICIENCY	0.962	0.999	0.974	0.968	0.953
ROTOR HEAD-RISE COEFFICIENT	0.282	0.245	0.191	0.148	0.119
FLOW COEFFICIENT	0.280	0.319	0.352	0.377	0.394
AIRFLOW PER UNIT FRONTAL AREA	62.55	71.02	78.00	83.17	86.69
AIRFLOW PER UNIT ANNULUS AREA	68.33	77.60	85.22	90.87	94.72
AIRFLOW AT ORIFICE	12.68	14.40	15.81	16.86	17.57
AIRFLOW AT IGV INLET	12.71	14.42	15.86	16.90	17.62
AIRFLOW AT ROTOR INLET	12.28	13.94	15.33	16.31	17.01
AIRFLOW AT ROTOR OUTLET	12.31	14.21	15.08	15.97	16.80
AIRFLOW AT STATOR OUTLET	12.60	14.22	15.38	16.33	16.98
ROTATIVE SPEED	7696.9	7698.7	7696.0	7687.5	7690.7
PERCENT OF DESIGN SPEED	70.7	70.7	70.7	70.6	70.6
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.117	1.103	1.081	1.062	1.044
STAGE TOTAL TEMPERATURE RATIO	1.042	1.034	1.029	1.024	1.019
STAGE ADIABATIC EFFICIENCY	0.760	0.828	0.791	0.730	0.652

(g) 60 Percent of design speed

READING NUMBER	0712
IGV TOTAL PRESSURE RATIO	0.996
ROTOR TOTAL PRESSURE RATIO	1.101
STATOR TOTAL PRESSURE RATIO	0.988
IGV TOTAL TEMPERATURE RATIO	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.031
STATOR TOTAL TEMPERATURE RATIO	0.999
ROTOR ADIABATIC EFFICIENCY	0.899
ROTOR MOMENTUM-RISE EFFICIENCY	0.982
ROTOR HEAD-RISE COEFFICIENT	0.269
FLOW COEFFICIENT	0.289
AIRFLOW PER UNIT FRONTAL AREA	56.01
AIRFLOW PER UNIT ANNULUS AREA	61.20
AIRFLOW AT ORIFICE	11.35
AIRFLOW AT IGV INLET	11.35
AIRFLOW AT ROTOR INLET	10.94
AIRFLOW AT ROTOR OUTLET	11.12
AIRFLOW AT STATOR OUTLET	11.27
ROTATIVE SPEED	6615.9
PERCENT OF DESIGN SPEED	60.8
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.084
STAGE TOTAL TEMPERATURE RATIO	1.030
STAGE ADIABATIC EFFICIENCY	0.783

TABLE IX. - OVERALL PERFORMANCE OF STAGE 57M2I

(a) 120 Percent of design speed

READING NUMBER	0729	0728	0727	0726	0725
IGV TOTAL PRESSURE RATIO	0.967	0.963	0.959	0.955	0.953
ROTOR TOTAL PRESSURE RATIO	1.403	1.363	1.301	1.256	1.228
STATOR TOTAL PRESSURE RATIO	0.933	0.946	0.968	0.981	0.982
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.998	0.998
ROTOR TOTAL TEMPERATURE RATIO	1.112	1.103	1.091	1.086	1.081
STATOR TOTAL TEMPERATURE RATIO	1.000	1.000	0.999	0.993	0.991
ROTOR ADIABATIC EFFICIENCY	0.906	0.900	0.856	0.786	0.745
ROTOR MOMENTUM-RISE EFFICIENCY	0.966	0.976	0.995	0.983	0.948
ROTOR HEAD-RISE COEFFICIENT	0.269	0.243	0.203	0.174	0.156
FLOW COEFFICIENT	0.262	0.273	0.286	0.295	0.298
AIRFLOW PER UNIT FRONTAL AREA	98.05	101.89	106.17	108.87	110.86
AIRFLOW PER UNIT ANNULUS AREA	107.12	111.32	116.00	118.95	120.25
AIRFLOW AT ORIFICE	19.87	20.65	21.52	22.07	22.31
AIRFLOW AT IGV INLET	19.84	20.61	21.48	22.06	22.26
AIRFLOW AT ROTOR INLET	19.60	20.32	21.23	21.74	21.88
AIRFLOW AT ROTOR OUTLET	19.04	19.71	20.61	21.46	21.71
AIRFLOW AT STATOR OUTLET	19.50	20.68	21.54	22.69	22.71
ROTATIVE SPEED	13101.6	13103.2	13094.3	13083.5	13092.3
PERCENT OF DESIGN SPEED	120.4	120.4	120.3	120.2	120.3
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.265	1.242	1.208	1.176	1.149
STAGE TOTAL TEMPERATURE RATIO	1.111	1.101	1.089	1.077	1.070
STAGE ADIABATIC EFFICIENCY	0.627	0.632	0.627	0.618	0.588

(b) 110 Percent of design speed

READING NUMBER	0724	0723	0722	0721	0720
IGV TOTAL PRESSURE RATIO	0.971	0.968	0.965	0.963	0.960
ROTOR TOTAL PRESSURE RATIO	1.322	1.285	1.248	1.217	1.187
STATOR TOTAL PRESSURE RATIO	0.949	0.963	0.978	0.982	0.980
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.093	1.083	1.078	1.072	1.065
STATOR TOTAL TEMPERATURE RATIO	0.999	0.999	0.996	0.994	0.992
ROTOR ADIABATIC EFFICIENCY	0.897	0.892	0.839	0.807	0.769
ROTOR MOMENTUM-RISE EFFICIENCY	0.968	0.981	0.998	1.003	0.971
ROTOR HEAD-RISE COEFFICIENT	0.259	0.230	0.202	0.177	0.154
FLOW COEFFICIENT	0.267	0.281	0.294	0.304	0.311
AIRFLOW PER UNIT FRONTAL AREA	91.55	95.71	99.84	102.83	105.11
AIRFLOW PER UNIT ANNULUS AREA	100.02	104.57	109.07	112.34	114.83
AIRFLOW AT ORIFICE	19.56	19.40	20.24	20.84	21.30
AIRFLOW AT IGV INLET	18.53	19.43	20.23	20.83	21.30
AIRFLOW AT ROTOR INLET	18.06	19.01	19.85	20.49	20.91
AIRFLOW AT ROTOR OUTLET	17.70	18.54	19.41	20.33	20.95
AIRFLOW AT STATOR OUTLET	18.27	19.33	20.45	21.17	21.40
ROTATIVE SPEED	11961.0	11951.0	11942.4	11937.3	11933.5
PERCENT OF DESIGN SPEED	109.9	109.8	109.7	109.7	109.6
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.219	1.197	1.178	1.151	1.117
STAGE TOTAL TEMPERATURE RATIO	1.090	1.081	1.072	1.064	1.055
STAGE ADIABATIC EFFICIENCY	0.647	0.653	0.662	0.643	0.583

(c) 100 Percent of design speed

READING NUMBER	0719	0718	0717	0716	0715
IGV TOTAL PRESSURE RATIO	0.976	0.974	0.971	0.967	0.965
ROTOR TOTAL PRESSURE RATIO	1.269	1.244	1.212	1.175	1.155
STATOR TOTAL PRESSURE RATIO	0.956	0.967	0.981	0.983	0.982
IGV TOTAL TEMPERATURE RATIO	0.999	0.999	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.078	1.071	1.066	1.058	1.054
STATOR TOTAL TEMPERATURE RATIO	0.998	0.999	0.997	0.994	0.992
ROTOR ADIABATIC EFFICIENCY	0.906	0.904	0.856	0.808	0.770
ROTOR MOMENTUM-RISE EFFICIENCY	0.971	0.989	1.004	1.006	0.985
ROTOR HEAD-RISE COEFFICIENT	0.259	0.235	0.206	0.171	0.151
FLOW COEFFICIENT	0.269	0.281	0.295	0.311	0.319
AIRFLOW PER UNIT FRONTAL AREA	84.82	88.50	92.42	97.08	99.25
AIRFLOW PER UNIT ANNULUS AREA	92.67	96.69	100.97	106.06	108.44
AIRFLOW AT ORIFICE	17.19	17.94	18.73	19.68	20.12
AIRFLOW AT IGV INLET	17.16	17.90	18.71	19.66	20.11
AIRFLOW AT ROTOR INLET	16.71	17.45	18.32	19.26	19.70
AIRFLOW AT ROTOR OUTLET	16.36	17.12	17.86	19.13	19.67
AIRFLOW AT STATOR OUTLET	16.84	17.78	18.83	19.77	20.02
ROTATIVE SPEED	10947.9	10948.9	10941.2	10931.4	10943.3
PERCENT OF DESIGN SPEED	100.6	100.6	100.5	100.4	100.5
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.185	1.172	1.154	1.118	1.095
STAGE TOTAL TEMPERATURE RATIO	1.076	1.069	1.062	1.050	1.045
STAGE ADIABATIC EFFICIENCY	0.656	0.670	0.677	0.641	0.588

TABLE IX. - Concluded. OVERALL PERFORMANCE OF STAGE 57M2I

(d) 90 Percent of design speed

READING NUMBER	0732
IGV TOTAL PRESSURE RATIO	0.981
ROTOR TOTAL PRESSURE RATIO	1.209
STATOR TOTAL PRESSURE RATIO	0.963
IGV TOTAL TEMPERATURE RATIO	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.062
STATOR TOTAL TEMPERATURE RATIO	0.999
ROTOR ADIABATIC EFFICIENCY	0.900
ROTOR MOMENTUM-RISE EFFICIENCY	0.971
ROTOR HEAD-RISE COEFFICIENT	0.253
FLOW COEFFICIENT	0.269
AIRFLOW PER UNIT FRONTAL AREA	76.29
AIRFLOW PER UNIT ANNULUS AREA	83.35
AIRFLOW AT ORIFICE	15.46
AIRFLOW AT IGV INLET	15.44
AIRFLOW AT ROTOR INLET	14.98
AIRFLOW AT ROTOR OUTLET	14.78
AIRFLOW AT STATOR OUTLET	15.28
ROTATIVE SPEED	9788.4
PERCENT OF DESIGN SPEED	89.9
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.142
STAGE TOTAL TEMPERATURE RATIO	1.060
STAGE ADIABATIC EFFICIENCY	0.646

(d) (e) 80 Percent of design speed

READING NUMBER	0735
IGV TOTAL PRESSURE RATIO	0.985
ROTOR TOTAL PRESSURE RATIO	1.163
STATOR TOTAL PRESSURE RATIO	0.973
IGV TOTAL TEMPERATURE RATIO	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.049
STATOR TOTAL TEMPERATURE RATIO	0.999
ROTOR ADIABATIC EFFICIENCY	0.903
ROTOR MOMENTUM-RISE EFFICIENCY	0.972
ROTOR HEAD-RISE COEFFICIENT	0.250
FLOW COEFFICIENT	0.269
AIRFLOW PER UNIT FRONTAL AREA	68.16
AIRFLOW PER UNIT ANNULUS AREA	74.46
AIRFLOW AT ORIFICE	13.81
AIRFLOW AT IGV INLET	13.79
AIRFLOW AT ROTOR INLET	13.37
AIRFLOW AT ROTOR OUTLET	13.12
AIRFLOW AT STATOR OUTLET	13.62
ROTATIVE SPEED	8711.0
PERCENT OF DESIGN SPEED	80.0
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.114
STAGE TOTAL TEMPERATURE RATIO	1.048
STAGE ADIABATIC EFFICIENCY	0.658

(f) 70 Percent of design speed

READING NUMBER	0737	0742	0741	0740	0739
IGV TOTAL PRESSURE RATIO	0.988	0.985	0.983	0.981	0.979
ROTOR TOTAL PRESSURE RATIO	1.120	1.101	1.083	1.069	1.056
STATOR TOTAL PRESSURE RATIO	0.982	0.990	0.992	0.990	0.990
IGV TOTAL TEMPERATURE RATIO	1.000	1.000	0.999	0.999	0.999
ROTOR TOTAL TEMPERATURE RATIO	1.036	1.031	1.027	1.024	1.021
STATOR TOTAL TEMPERATURE RATIO	1.000	0.999	0.998	0.997	0.997
ROTOR ADIABATIC EFFICIENCY	0.911	0.895	0.851	0.808	0.738
ROTOR MOMENTUM-RISE EFFICIENCY	0.983	1.021	1.035	1.017	0.972
ROTOR HEAD-RISE COEFFICIENT	0.241	0.203	0.166	0.139	0.113
FLOW COEFFICIENT	0.275	0.302	0.325	0.342	0.354
AIRFLOW PER UNIT FRONTAL AREA	61.00	66.72	71.76	75.47	78.12
AIRFLOW PER UNIT ANNULUS AREA	66.65	72.89	78.40	82.46	85.35
AIRFLOW AT ORIFICE	12.36	13.52	14.54	15.30	15.83
AIRFLOW AT IGV INLET	12.37	13.53	14.57	15.32	15.85
AIRFLOW AT ROTOR INLET	11.98	13.14	14.15	14.86	15.34
AIRFLOW AT ROTOR OUTLET	11.74	12.97	14.09	14.96	15.37
AIRFLOW AT STATOR OUTLET	12.20	13.46	14.40	14.96	15.35
ROTATIVE SPEED	7605.7	7613.5	7637.6	7633.8	7640.6
PERCENT OF DESIGN SPEED	69.9	69.9	70.2	70.1	70.2
COMPRESSOR PERFORMANCE					
STAGE TOTAL PRESSURE RATIO	1.086	1.074	1.057	1.038	1.024
STAGE TOTAL TEMPERATURE RATIO	1.036	1.030	1.025	1.020	1.017
STAGE ADIABATIC EFFICIENCY	0.669	0.680	0.644	0.535	0.389

(g) 60 Percent of design speed

READING NUMBER	0743
IGV TOTAL PRESSURE RATIO	0.991
ROTOR TOTAL PRESSURE RATIO	1.085
STATOR TOTAL PRESSURE RATIO	0.988
IGV TOTAL TEMPERATURE RATIO	1.000
ROTOR TOTAL TEMPERATURE RATIO	1.026
STATOR TOTAL TEMPERATURE RATIO	1.000
ROTOR ADIABATIC EFFICIENCY	0.915
ROTOR MOMENTUM-RISE EFFICIENCY	0.991
ROTOR HEAD-RISE COEFFICIENT	0.233
FLOW COEFFICIENT	0.281
AIRFLOW PER UNIT FRONTAL AREA	53.34
AIRFLOW PER UNIT ANNULUS AREA	58.28
AIRFLOW AT ORIFICE	10.81
AIRFLOW AT IGV INLET	10.84
AIRFLOW AT ROTOR INLET	10.46
AIRFLOW AT ROTOR OUTLET	10.35
AIRFLOW AT STATOR OUTLET	10.74
ROTATIVE SPEED	6512.7
PERCENT OF DESIGN SPEED	59.8
COMPRESSOR PERFORMANCE	
STAGE TOTAL PRESSURE RATIO	1.062
STAGE TOTAL TEMPERATURE RATIO	1.026
STAGE ADIABATIC EFFICIENCY	0.682

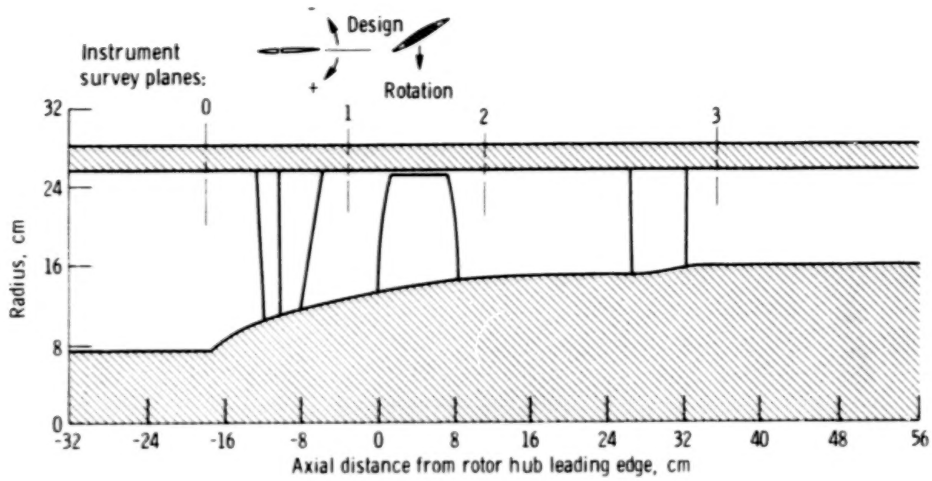


Figure 1. - Flow path for stage 57M2.

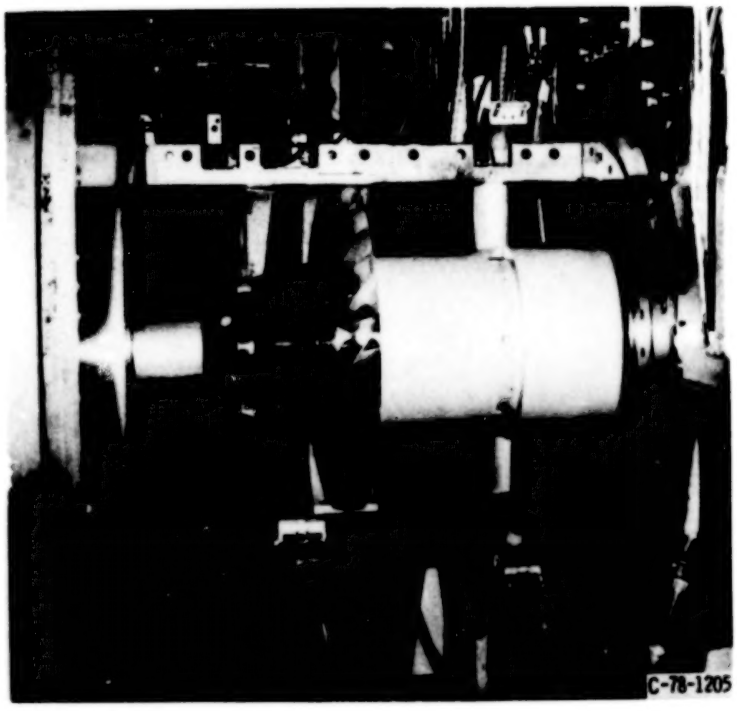


Figure 2. - Test stage.

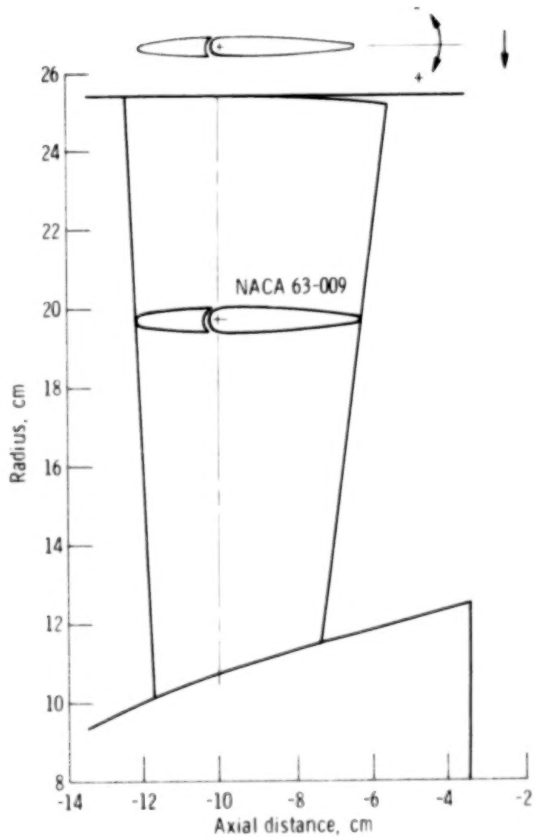


Figure 3. - Schematic of variable-inlet-guide vane.

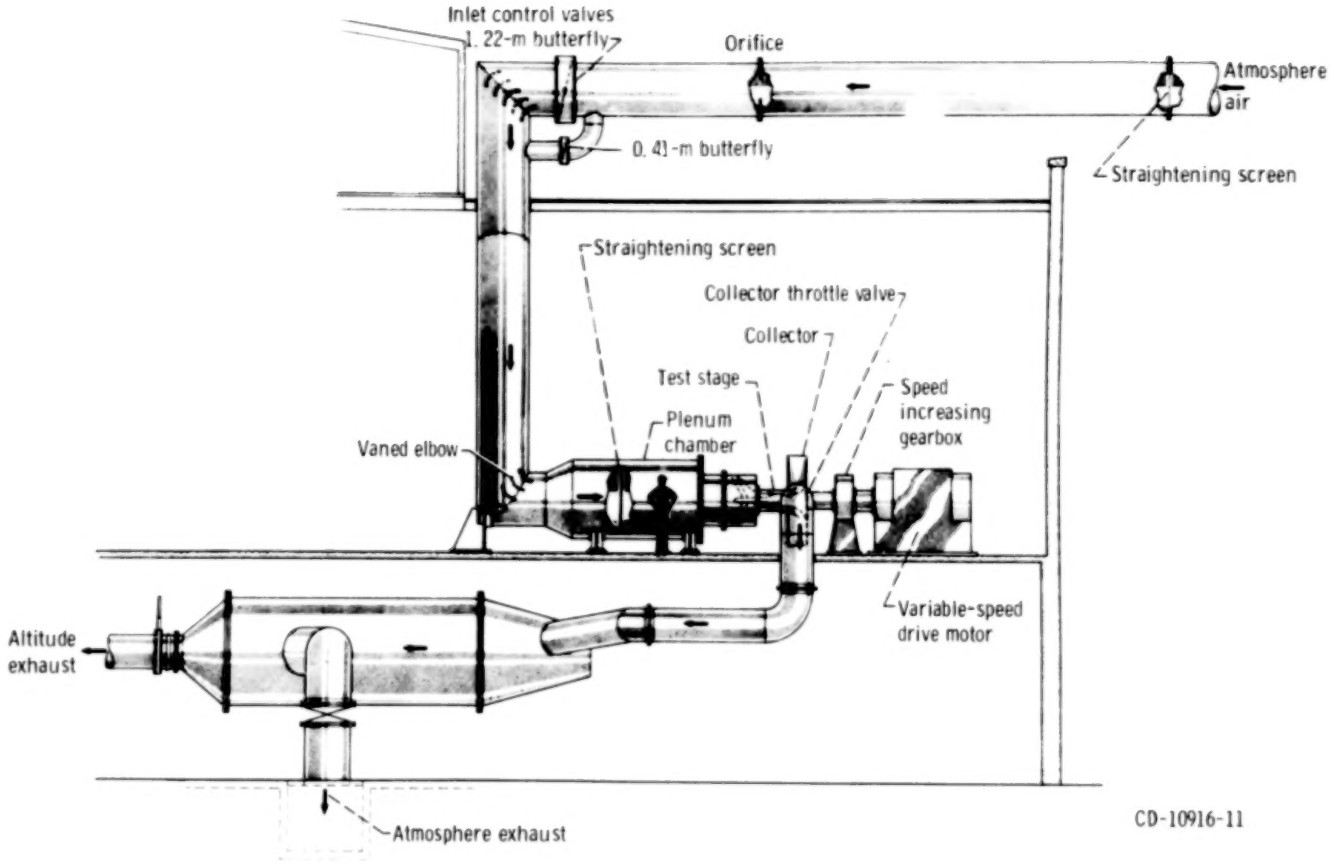


Figure 4. - Single-stage compressor test facility.

(a) Combination probe.

(b) Wedge static probe.

(c) Station 1 rake.

(d) Station 3 rake.

Figure 5. - Instrumentation

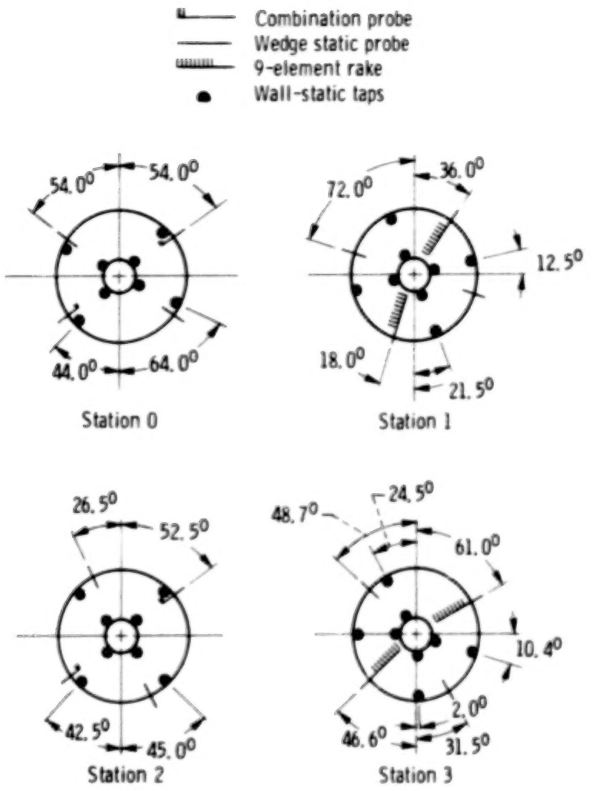


Figure 6. - Circumferential location of instrumentation (looking downstream).

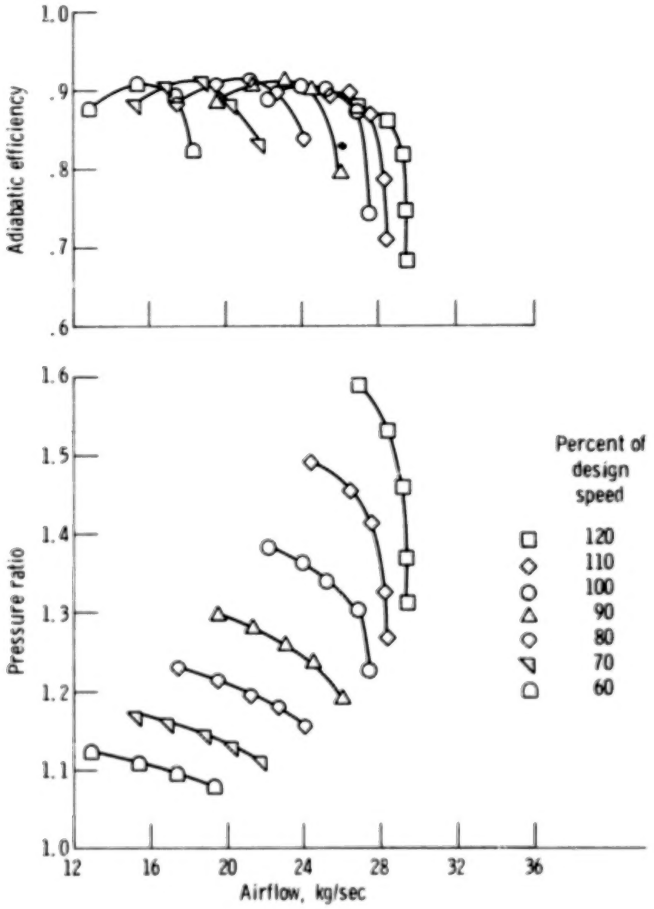


Figure 7. - Overall performance of rotor 57M2A (IGV angle, 0^0; rotor blade setting angle, 6^0, closes).

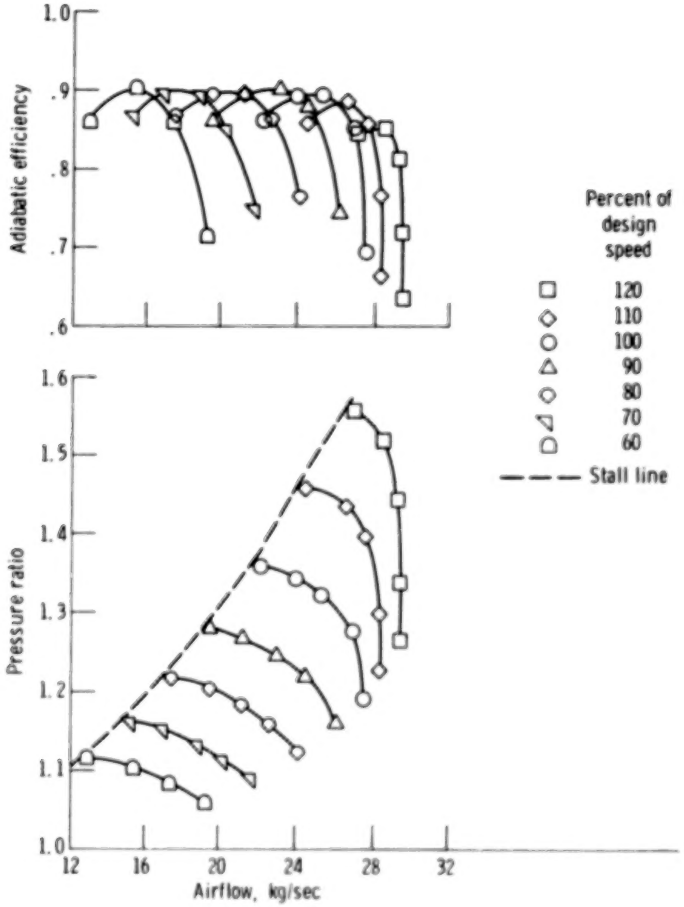
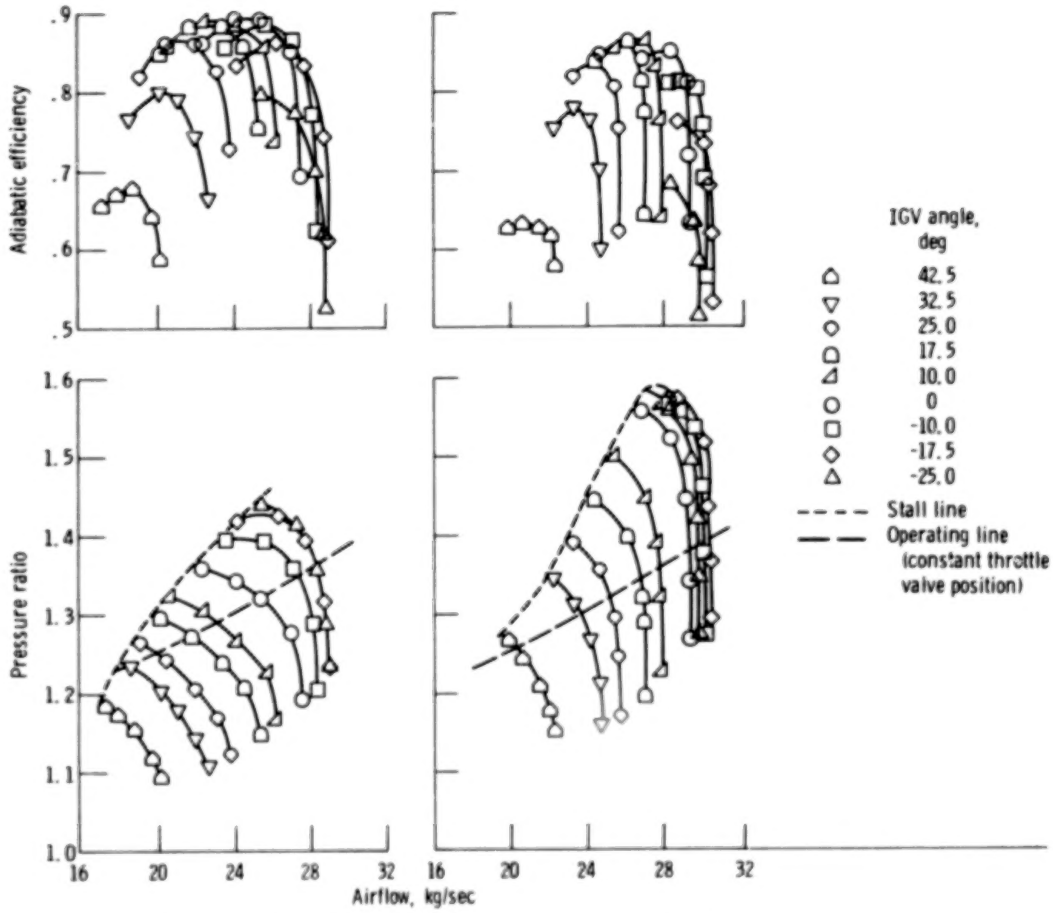
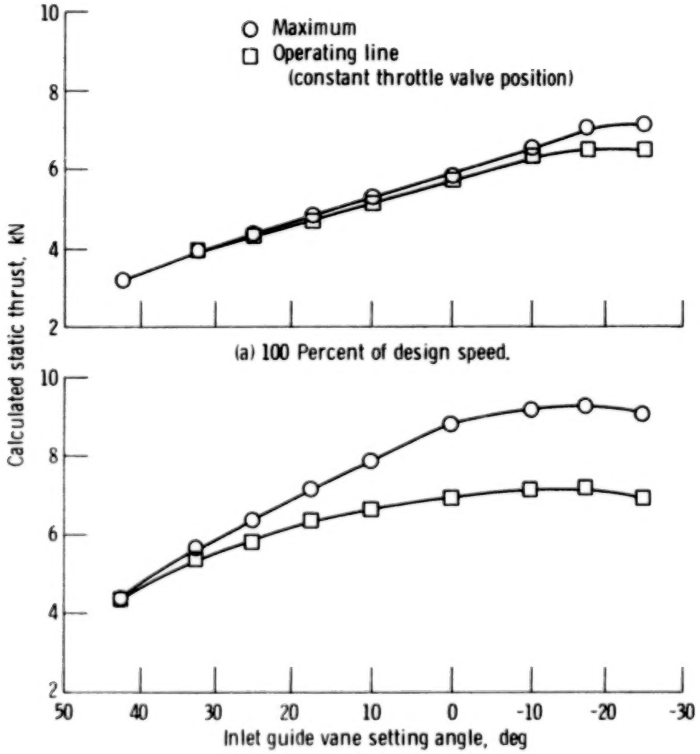


Figure 8. - Overall performance of stage 57M2A (IGV angle, 0^{o}).



(a) 100 Percent of design speed. (b) 120 Percent of design speed.

Figure 9. - Effect of inlet-guide-vane angle on overall stage performance.



(a) 100 Percent of design speed.

(b) 120 Percent of design speed.

Figure 10. - Effect of inlet guide vane angle on calculated static thrust.

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15. Supplementary Notes

16. Abstract

The overall performance of a fan stage with nine inlet-guide-vane angle settings is presented. These data were obtained over the stable flow range at speeds from 60 to 120 percent of design for vane setting angles from -25^{o} to 42.5^{o}. At design speed and design inlet guide vane angle, the stage had a peak efficiency of 0.892 at a pressure ratio of 1.322 and a flow of 25.31 kilograms per second. The stall margin based on peak efficiency and stall was 20 percent. Based on an operating line passing through the peak efficiency point at the design setting angle, the useful operating range of the stage at design speed is limited by stall at the positive setting angles and by choke at the negative angles. At design speed the calculated static thrust along the operating line varied from 68 to 114 percent of that obtained at design setting angle.

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